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ABSTRACT

This curriculum guide is designed to offer guidelines along with supporting resources and teaching ideas from which the local postsecondary instructor can extract a machine shop curriculum that meets local needs. Following an outline of the philosophy and goals underlying state and local vocational education programs in Georgia, the purpose and objectives of the guide are explained. Covered next are the nature and scope of machine shop-related occupations, employability skills that are necessary in such jobs, student exit points, and tasks performed in various job classifications. A sample curriculum structure and a course outline are provided. The bulk of the guide consists of a series of unit guides, each of which contains a task statement, a performance objective, instructional activities, suggested instructional materials, and evaluation criteria. Also included is a shop projects/duty areas cross reference matrix. The next two sections consist of listings of references and resources and student records. Suggestions are set forth for working with special needs students. Also supplied are facility layouts for a learning laboratory and a learning resource center. (MN)

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MACHINE SHOP

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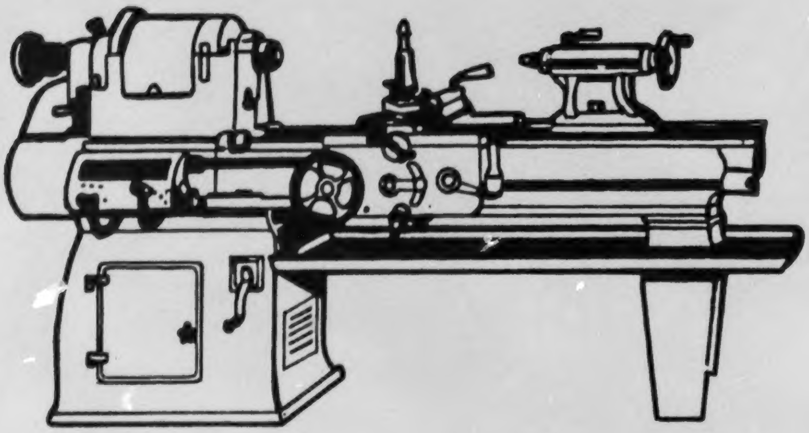

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CURRICULUM GUIDE

Georgia Department of Education

MACHINE SHOP

Developed Under Contractual Agreement with

Division of Program Development
Office of Vocational Education
Georgia Department of Education
Atlanta, Georgia 30334
Charles McDaniel, State Superintendent of Schools
1981

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MACHINE SHOP

Developed By

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POLICIES AND PROCEDURES FOR THE CENTER

PURPOSE OF THE CENTER

The Vocational Education Materials Center functions within the Division of Vocational Education, University of Georgia. This Center operates under grants from the U.S. Office of Education, and the Georgia State Department of Education with the support of the College of Education. The Center is comprehensive in its commitment and approach to the development and dissemination of materials in the broad field of Vocational Education.

The purpose of the Center is to increase the capability of Georgia's delivery system for Vocational Education. Specifically, the Center is committed to:

1. Develop materials to assist in the implementation of proposed curricula and to enhance the teaching of Vocational Education.
2. Conduct and report curriculum research related to Vocational Education.
3. Provide a production and dissemination center for Vocational Education materials.
4. Provide direct experiences in curriculum development and diffusion for advanced graduate students.
5. Enable faculty members to participate in the development and implementation of a variety of curriculum materials.

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-Foreword-

It has been the privilege of the Division of Vocational Education, University of Georgia, to participate in the development of 48 curriculum guides for Georgia vocational education programs. This work was sponsored by the Division of Program Development, Office of Vocational Education, State Department of Education. The completion of these guides meets a long standing need to provide a comprehensive curriculum overview of the vocational education programs available in Georgia schools. This developmental activity involved one of the largest professional staffs ever assembled for such work. Numerous teachers, teacher educators and state staff members have either written parts of the guides or served on the field review teams. These professionals were supported by a myriad of technical people and a host of typists who literally worked from dawn to dusk to ensure that the guides were produced in a timely fashion.

Be assured that this guide is not intended to be your curriculum or the curriculum of any school. The purpose of this project staff, and I am sure of the state OVE staff, is to offer a guide with supporting resources and teaching ideas from which the vocational instructor can extract a curriculum that meets local needs. The guide, however, does simplify curriculum decisions concerning sequencing and the selection of resources and media support.

The Task Linkage Project and appropriate V'TECS catalogs were used as the beginning point for this guide and all of the others. To assure that these task listings were directly related to Georgia vocational education programs and industry, they were subjected to additional study and review by appropriate teachers.

At some point in the future, this guide will need to be revised. To ensure that such a revision truly reflects the needs of Georgia's vocational education programs, the developers need your reactions, comments and ideas. We will also be interested in how you use the guide. Let us hear from you.

Paul Scott
Curriculum Guide Projects I & II

SECTION I

PHILOSOPHY & GOALS

VOCATIONAL EDUCATION IN GEORGIA

A. PHILOSOPHY

The Georgia Board of Education perceives vocational education as a vital component in the education of the young and adult citizens of this State. Appropriate programs of vocational education and ancillary services should be made readily available to individuals in middle schools, high schools, postsecondary area vocational-technical schools, vocational divisions of junior colleges, vocational centers, the Quick Start program and other adult programs designed to train or retrain workers for useful and satisfying employment.

Special services and assistance must be provided to those who need it in order to participate or benefit from vocational education. This includes women, minorities, the displaced homemaker and other displaced workers, those with limited English-speaking ability, the disadvantaged and the handicapped.

Since men and women spend the greater part of their lives at some form of work, the State should provide opportunities for all its citizens to develop the knowledge, skills and attitudes necessary for them to secure personally satisfying and socially useful employment.

B. PURPOSE

The purpose of vocational education shall be to improve the economic well-being of Georgia citizens by preparing individuals, through organized learning experiences, to select, obtain and advance in recognized occupations.

POSTSECONDARY VOCATIONAL EDUCATION

A. PURPOSE

The purpose of postsecondary vocational-technical education in Georgia is to improve the economic well-being of adult citizens by providing access to high quality vocational-technical training for skilled and semi-skilled occupations, for improvement of existing skills or for retraining in a new occupation.

B. OBJECTIVES

1. To provide vocational-technical education programs and ancillary services commensurate with the needs and interests of students and available job opportunities.
2. To provide vocational-technical education programs which are current with the state-of-the-art, competency-based, and offer multiple exit points to accomodate the students' occupational objectives.
3. To provide vocational-technical education programs which are articulated with available high school counterparts, to facilitate an easy transition from secondary to postsecondary levels without loss of credit.
4. To provide vocational-technical education programs such that 75% of those individuals who leave or complete a program of occupational preparation will find employment in the field, or a related field, for which trained.
5. To provide those guidance, counseling, financial aid, evaluative, job placement, remedial and other supportive programs and services needed by students to enroll, complete a program and become, or remain, employable in a skilled or semi-skilled occupation.
6. To provide needed assistance to special populations to include women, minorities, limited English-speaking, the displaced homemaker and other displaced workers, the disadvantaged and the handicapped.
7. To provide vocational-technical education programs for full-time and part-time students on campus during the day as well as the evening hours, and to provide appropriate programs for full-time and part-time students off campus in businesses and industries, comprehensive high schools and other locations within the respective schools' service areas.
8. To serve as a center for the delivery of postsecondary and adult vocational-technical education programs and services for the community and assigned service area.

STATEMENT OF LOCAL SYSTEM PHILOSOPHY, PURPOSE AND GOALS FOR VOCATIONAL EDUCATION

(This page is intentionally left blank so that local systems may insert their copy of philosophy, purpose and goals for vocational education).

SECTION II

PURPOSE & OBJECTIVES

PURPOSE OF GUIDE

The purpose is defined in terms of the functional needs of each of the identified classes of users in the secondary and post secondary systems.

(a) Vocational teachers.

1. Provide a guide for organizing their program of instruction,
2. Assist in establishing program objectives,
3. Serve as a curriculum materials resource guide,
4. Improve communications with employers and advisory committees,
5. Facilitate competency based instruction,
6. Facilitate either group or self-paced instruction,
7. Include content by quarter and semester,
8. Cross-reference with existing state developed instructional materials (PLACE packages and post secondary I.I.).

(b) Vocational supervisors and administrators.

1. Assist in defining the scope and content of their programs,
2. Provide a means to improve curriculum management functions,
3. Serve as a guide for admissions and job placement functions,
4. Improve communications with employers and advisory committees.

(c) Counseling and guidance staff.

1. Provide a data base for counseling and guidance personnel,
2. Identify student exit points (Carrer Options),
3. Serve as guide for admissions and job placement,
4. Correlate with the new State Board of Education graduation requirements,
5. Provide specific content sequencing by quarter and semester for student scheduling,
6. Provide (a) curriculum options for the disadvantaged handicapped student, (b) curriculum modifications for SPECIAL NEEDS students, (c) typical admission requirements for regular and SPECIAL NEEDS students.

(d) Local Curriculum Coordination Committees.

1. Serve as a guide in working out articulation arrangements,
2. Improve definitions of the relationship between secondary clusters and post secondary specialized programs.

This guide will serve as an ideal communication device between school personnel and the craft advisory committee. By personally reviewing the guide with the local craft advisory committee the teacher will be able to maintain the accuracy of the guide in terms of the local job market and will also be able to inform representatives of local industry regarding the content of the program itself.

MACHINE SHOP PROGRAM OBJECTIVE

Given appropriate instruction, as suggested by this guide, a student completing the program should demonstrate entry level skills in Machine Shop in the areas of knowledge, theoretical structure, tool usage, diagnostic ability, related supportive skills and occupational survival skills.

As the student progresses through the program, sufficient competencies will be acquired to enable the student to enter the occupational field at the following curriculum exit points.

Grinder Operator	(D.O.T. Code 603.280-038)
Drill Press Operator	(D.O.T. Code 606.682-014)
Milling Machine Operator	(D.O.T. Code 605.685-030)
Lathe Operator	(D.O.T. Code 604.685-026)
Machinist	(D.O.T. Code 600.280-022)

SECTION III

D. O. T. DESCRIPTION, EXIT POINTS, TASKS

DESCRIPTION OF OCCUPATIONAL FIELD

The primary purpose of this section is to provide a general orientation to the occupational field. This orientation may be used by counseling and guidance staff in helping students to select subject areas. It may also be used by instructors for new students just entering the program area. The description delimits the scope of the occupational field in terms of the range of activities involved in a series of occupations. It contains information about career potential within the occupational field, including job market conditions and trends.

The description identifies prerequisite skills and knowledge for those students interested in entering the occupational field. In addition, the Description of Occupational Exit Points is provided to aid the instructor in identifying possible jobs for early leavers. A listing of employability skills is also included in this section.

*Machinists

Nature of the Work

Machinists are skilled metal workers who can turn a block of metal into an intricate part, such as a gear or piston, that meets precise specifications. They know how to set up and operate most types of machine tools used to make metal parts for cars, machines, and other equipment. They also know the working properties of a variety of metals such as steel, cast iron, aluminum, brass, and other metals that are used to make these parts. Using this knowledge of metals, plus their skill with machine tools, production machinists plan and carry out all the operations needed to make a machined product.

Before they actually begin work on a part, machinists usually consult blueprints or written specifications for the item. Using these, they select tools and materials for the job and plan the cutting and finishing operations. When making a rifle barrel, for example, they might select an alloy steel workpiece and then use a boring machine to cut out the rifle bore. After selecting a workpiece and the appropriate machine for the job, machinists make standard shop computations relating to dimensions of work and machining computations. They must, for example, determine the exact point on the workpiece where they will bore the hole. They also must decide how fast they can feed the metal workpiece into the machine, and what cooling oils they should use to keep the metal from overheating and ruining the job.

To be sure their work is accurate, they check it using precision instruments, such as micrometers, which measure to thousandths or even millionths of an inch. After completing machining operations, they may use hand files and scrapers to smooth rough metal edges before assembling the finished parts with wrenches and screwdrivers.

Like production machinists, all-round machinists who work in plant maintenance shops have a broad knowledge of metals, of how machines work, and of machining operations. These workers are responsible for repairing parts or making new parts for machinery that has broken down. They sometimes also adjust and test the parts they have made or repaired for a machine.

Working Conditions

The work environment for machinists has improved considerably in recent years. Most machine shops are clean, well lighted and well ventilated. Many modern shops are air-conditioned. Noise levels also have been reduced with the introduction of better designed machine tools. In those shops where noise still is a problem, workers wear earmuffs or earplugs to protect their hearing. Good "housekeeping" now is emphasized in most machine shops, and helps make shops safer by reducing the chances of accidents caused by slippery floors or blocked aisles between the machine tools.

Working around high-speed machine tools, however, can still present certain dangers. Flying pieces of hot metal, for example, can cause burns and cuts. As a result, machinists must follow strict safety practices. Safety glasses with side shields, and other protective devices must be worn; loose or billowy clothing, long hair, and rings or other jewelry are prohibited. These regulations help prevent once common accidents, such as burns from hot metal, cuts and other injuries caused by flying metal pieces, and parts of the body getting caught and mangled in the machine tool.

Places of Employment

About 400,000 persons worked as machinists in 1978. Almost every factory that uses substantial amounts of machinery employs all-round machinists to maintain its mechanical equipment. In some factories, machinists make large quantities of identical parts such as automobile axle shafts in production departments. In others, machinists make limited numbers of varied products such as missle motor cases in machine shops.

Most all-round machinists work in the following industries: Machinery, including electrical; transportation equipment; fabricated metal products; and primary metals. Other industries employing substantial numbers of these workers are the railroad, chemical, food processing, and textile industries. The Federal Government also employs all-round machinists in Navy yards and other installations.

Although machinists work in all parts of the country, jobs are most plentiful in areas where many factories are located. Among the leading areas of employment are Los Angeles, Chicago, New York, Philadelphia, Boston, San Francisco and Houston.

Training, Other Qualifications and Advancement

A 4-year formal apprenticeship is the best way to learn the machinist trade, but some companies have training programs for single-purpose machines that require less than 4 years to complete. Many machinists do learn this trade on the job, however.

Persons interested in becoming machinists should be mechanically inclined so that they can use the tools and machines required in their work and so that they can understand the often complex mechanisms it is their job to build. They also should be temperamentally suited to do highly accurate work that requires concentration as well as physical effort. Prospective machinists should be able to work independently. Although the work sometimes is tedious and repetitious, all-round machinists frequently have the satisfaction of seeing the final results of their work. They also often are able to switch from making one product to another; as a result, variety is a major feature of all-round machinists' work.

A high school or vocational school education, including mathematics, physics, or machine shop training, is desirable. Some companies require experienced machinists to take additional courses in mathematics and electronics at company expense so that they can work with newer metalworking technologies, such as numerically controlled machine tools. In addition, equipment builders generally provide training in the electrical, hydraulic, and mechanical aspects of machine-and-control systems.

Typical machinist apprentice programs consist of approximately 8,000 hours of shop training and about 570 hours of related classroom instruction. In shop training, apprentices learn chipping, filing, hand tapping, dowel fitting, riveting and the operation of various machine tools. In the classroom, they study blueprint reading, mechanical drawing, shop mathematics, and shop practices.

All-round machinists have numerous opportunities for advancement. Many become supervisors. Some take additional training and become tool-and-die or instrument makers. Skilled machinists may open their own shops or advance into other technical jobs in machine programming and tooling.

Employment Outlook

The number of all-round machinists is expected to increase at about the same rate as the average for all occupations through the 1980's. Growth in the demand for machined metal parts will cause most of the increase. In addition to openings created by growth in this large occupation, many openings will arise from the need to replace experienced machinists who retire, die, or transfer to other fields of work.

As population and income rise, so will the demand for machined goods, such as automobiles, household appliances, and industrial products. However, technological developments that increase the productivity of machinists are expected to keep employment from rising as fast as the demand for machined good.

Chief among these technological innovations is the use of numerically controlled machine tools. These machines, which use computers to control various machining operations, significantly reduce the time required to perform machining operations.

Much of the employment growth will occur in the maintenance shops of manufacturing plants as industries continue to use a greater volume of complex machinery and equipment. More skilled maintenance machinists will be needed to prevent costly breakdowns in highly mechanized plants. Often the breakdown of just one machine can stop an entire production line for hours.

Earnings

The earnings of machinists compare favorably with those of other skilled workers. Machinists employed in metropolitan areas had estimated average hourly earnings of $8.02 in 1978. Because machinists work indoors, they are able to work year round and in all kinds of weather. As a result, their earnings are relatively stable. Many also receive numerous opportunities for overtime work.

Many machinists are members of unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; the International Brotherhood of Electrical Workers; and the United Steelworkers of America.

Related Occupations

The occupations most closely related to all-round machinists are, of course, the other machining occupations. These include tool-and-die makers, machine tool operators, setup workers (machine tool), and instrument makers. There are other occupations that require precision and skill in working with metal, however, including arc cutters, blacksmiths, gunsmiths, locksmiths, patternmakers (metal) and welders.

Sources of Additional Information

The National Machine Tool Builders Association, 7901 Westpark Drive, McLean, Virginia, 22120-whose members build a large proportion of all machine tools used in this country-will supply, on request, information on career opportunities in the machine tool industry.

The National Tool, Die and Precision Machining Association, 9300 Livingston Road, Washington, D.C., 20022, offers information on apprenticeship training, including recommended standards for tool-and-die makers certified by the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The Tool and Die Institute, 777 Busse Highway, Park Ridge, Illinois, 60068-a trade association-offers information on apprenticeship training in the Chicago area.

Many local offices of State employment services provide free aptitude testing to persons interested in becoming all-round machinists or tool-and-die makers. In addition, the State employment service refers applicants for apprentice programs to employers. In many communities, applicants for apprenticeship also are received by labor-management apprenticeship committees.

Apprenticeship information also may be obtained from the following unions (which have local offices in many cities):

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, Skilled Trades Department, 8000 East Jefferson Avenue, Detroit, Michigan, 48214.

International Union of Electrical, Radio and Machine Workers, 1126 16th Street, N.W., Washington, D.C., 20036.

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*Occupational Outlook Handbook, 1980-1981 Edition

*DESCRIPTION OF OCCUPATIONAL EXIT POINTS

603.280-018 GRINDER OPERATOR

Sets up and operates variety of grinding machines, such as external, internal, and surface grinders, to grind metal workpieces, such as machine parts, dies, or tools, according to knowledge of grinding procedures: Studies blueprint or layout on workpiece to visualize grinding to be done, and plans sequence of operations. Selects grinding wheel, applying knowledge of abrasives and metal properties, and secures it on spindle, using wrench. Dresses wheel with dressing device. Lifts workpiece manually or with hoist, and positions and secures workpiece to holding device, using wrenches and clamps. Selects feed rates, grinding speeds, depth of cuts, and grinding wheel of size, shape, and grade for each operation, applying knowledge of metal properties, abrasives, product specifications, and shop mathematics. Positions and tightens stop to limit travel of workpieces or grinding wheel. Moves controls to position wheel and workpiece in relation to each other, and to set feed, speed, and depth of cut. Starts machine, turns handwheel to feed grinding wheel to workpiece of vice versa, and engages power feeding device. Turns valve handle and directs flow of coolant against wheel and workpiece. Observes operation and adjusts position and action of wheel and workpiece. Verifies dimensions of ground workpieces for conformance to specifications, using measuring instruments, such as templates, micrometers, dial indicators, and gage blocks. Works to tolerances of plus or minus 0.0001 inch. May measure, mark, and scribe workpiece to lay it out for grinding {LAY-OUT WORKER (mach. shop)}. May dress grinding wheels to complex profiles, using special fixtures and tools. May grind nonmetallic materials, such as plastics. May operate tracer attachment to duplicate contours from templates or models. May be required to have specialized experience with particular materials, product, or precision level, or with machine of particular size, type, or trade name.

606.682-014 DRILL PRESS OPERATOR

Sets up and operates single-spindle drill press to perform such machining operations as drilling, countersinking, spotfacing, and tapping holes in metal workpieces, according to specifications, tooling instruments, standard charts, and knowledge of machining procedures: Reads blueprint, or job order and tooling instructions for specifications, such as hole locations and size, feed rates, cutting speeds, and cutting tools to be used. Secures specified tool in spindle. Lifts workpiece manually or with hoist, places it in fixture or jig or on machine table, and secures it with clamps or holds it in position under spindle. Moves controls to set cutting speed, feed rate, and depth of cut. Engages power or automatic feed or manually operates feed lever to feed tool to specified depth in workpiece. Turns valve handle to start flow of coolant against tool and workpiece or dips tool in cutting oil prior to mounting. Verifies conformance of machined workpieces to specifications, using such measuring instruments as calipers, micrometers, and fixed gauges. May position and secure drilling jig to guide cutting tool. May tilt table or spindle to machine holes at specified angles. May work on nonmetallic materials. May measure, mark, scribe, and center punch workpieces to mark hole locations.

605.685-030 MILLING MACHINE OPERATOR

Tends one or more previously setup milling machines to mill surfaces of metal workpieces to specifications on production basis: Positions and secures workpiece in fixture or feeding device. Starts machine, and turns handwheel to feed workpiece to cutter or vise versa, or engages feeding mechanism. Changes worn cutters, using wrenches. Verifies conformance of work to specifications, using instruments, such as fixed gauges, calipers, micrometers, go-not-go gauges, and templates. Records production output. May tend machine which mills workpiece according to programmed cycle. May turn controls to adjust feed rate of workpiece or speed of cutting tool. May turn valve handle and direct flow of coolant against cutter and workpiece. May mill nonmetallic materials.

604.685-026 LATHE OPERATOR

Tends one or more previously setup lathes, such as turret lathes, engine lathes, and chucking machines, to perform one or series of repetitive operations, such as turning, boring, threading, or facing, of metal workpieces according to specifications on production basis: Lifts workpiece manually or with hoist, and positions and secures it between lathe centers, in chuck or in holding fixture, using winch, or places it with automatic loading mechanism. Starts machine and turns handwheels to feed tools to workpiece, or engages automatic feed. Observes machining operation to detect malfunction or excessive tool wear. Verifies conformance of machined work to specifications, using fixed gauges, calipers, and micrometers. Changes worn tools, using wrenches. May machine plastics or other non-metallic materials.

600.280-022 MACHINIST

Sets up and operates machine tools, and fits and assembles parts to make or repair metal parts, mechanisms, tools or machines, applying knowledge of mechanics, shop mathematics, metal properties, and layout and machining procedures: Studies specifications, such as blueprint, sketch, damaged part, or description of part to be replaced, to determine dimensions and tolerances of piece to be machined, sequence of operations, and tools, materials, and machines required. Measures, marks, and scribes dimensions and reference points to lay out stock for machining {LAY-OUT WORKER (mach. shop)}. Sets up and operates metal-removing machines, such as lathe, milling machine, shaper, or grinder, to machine parts to specifications. Verifies conformance of workpiece to specifications, using measuring instruments {TOOL-MACHINE SET-UP OPERATOR (mach. shop)}. Positions and secures workpiece in holding device, such as chuck or collet, or on surface plate or worktable with such devices as vises, V-blocks, and angle plates, and uses handtools, such as files, scrapers, and wrenches, to fit and assemble parts to assemblies or mechanisms. Verifies dimensions and alignment with measuring instruments, such as micrometers, height gauges, and gauge blocks. May operate mechanism or machine, observe operation, or test with inspection equipment, to diagnose malfunction of machine or to test repaired machine. May perform flame cutting and arc or gas welding operations, when required. May develop specifications from general description and draw or sketch product to be made.

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*_Dictionary of Occupational Titles_, Fourth Edition, 1977.

EMPLOYABILITY SKILLS

In addition to the aptitudes, abilities, interests, physical requirements and job skills listed in the preceding Description of Occupation, employability skills exert a great deal of influence on a person's ability to get and keep a job. Surveys indicate that more people lose their jobs because of poor attitudes toward their job than for lack of job skills. For this reason it is important that information concerning the following employability skills be provided as an ongoing part of the program.

1. Getting a job
    a. Filling out job applications
    b. Developing a resume
    c. Preparing for a job interview

2. Keeping a job
    a. Be on time and regular in attendance
    b. Maintain a fair share of the work-load
    c. Work without supervision
    d. Meet production schedules
    e. Properly care for and use equipment
    f. Dress appropriately for the job
    g. Maintain good personal hygiene
    h. Develop and maintain good communication with supervisors and co-workers

A recent study sponsored by the Illinois Department of Adult, Vocational and Technical Education and conducted by the University of Illinois, "Survival Skills: Mastering the Human Aspects of Work", has identified twelve topics that might be developed into instructional modules for teaching occupational survival skills. The author, Robert E. Nelson, outlines these topics listed below and on the next page, each followed by a general objective which indicates the relationship between the topic and the survival skills required to maintain a job.

*"1. Working in an Organization: To familiarize students with the reasons for the formation of organizations and the common characteristics of organizations.
2. Understanding Self and Others: To have students develop insights into causes of human behavior and learn to interpret their own behavior and the behavior of others.
3. Motivation for Work: To have students develop an understanding of motivation for work and the ability to build positive motivations into the work they perform.

4. Interpersonal Relations: To have students develop concepts and skills in interpersonal relations and apply them to work situations.
5. On-the-Job Communication: To have students understand the importance of effective communication and learn ways of communicating effectively on the job.
6. Using Creativity on the Job: To make students aware of their creative potential and to practice using their creative ability in hypothetical on-the-job situations.
7. Authority and Responsibility: To have students develop an understanding of the concepts of authority, power, influence, and responsibility as they apply to work situations.
8. Problem Solving: To have students develop skill in applying problem solving to their work.
9. Coping with Organizational Change: To make students aware of the process of organizational change and the techniques for coping with organizational change.
10. Coping with Organizational Conflict: To make students aware of the sources and types of conflicts encountered on the job and recognize ways of coping with conflicts in an organization.
11. Leadership: To have students recognize the need for leadership in work groups and increase their understanding of the leadership role in work situations.
12. Adapting and Planning for the Future: To have students develop perspectives of work in the future and the ability to plan for anticipated changes in their work roles."

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*Abstracted from the article, "Survival Skills: Mastering the Human Aspects of Work," by Robert E. Nelson, *American Vocational Journal*, November 1977.

MACHINE SHOP EXIT POINTS

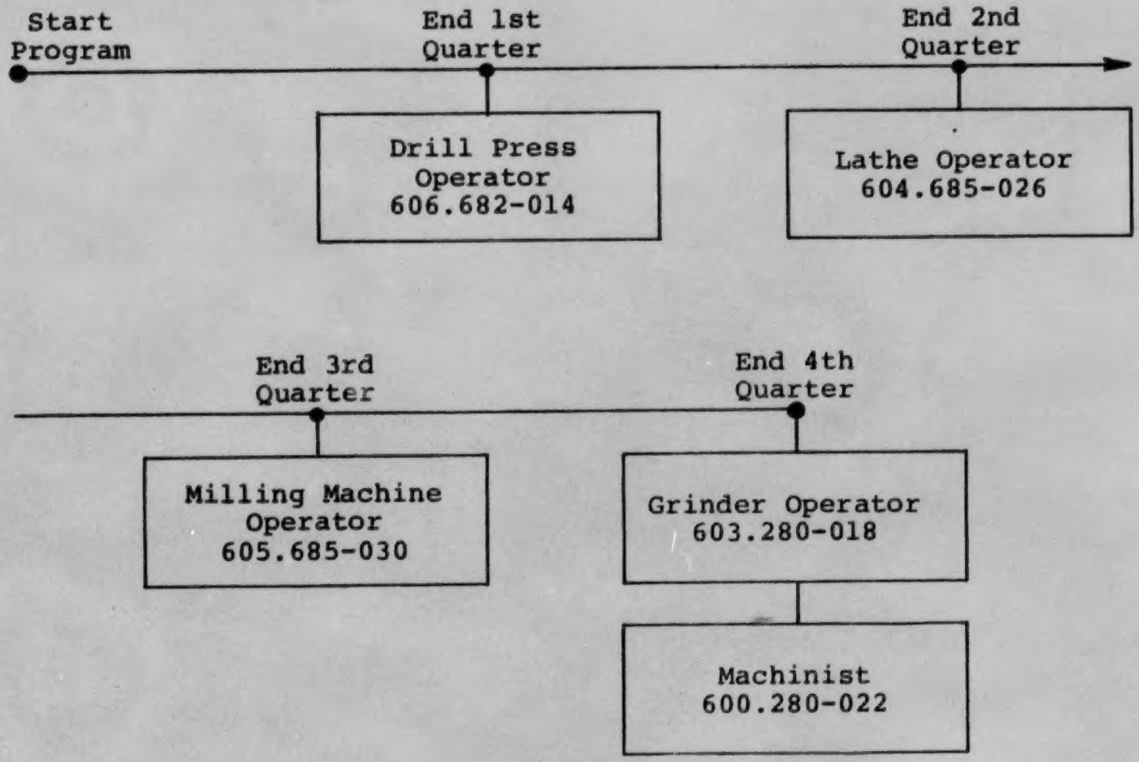
The diagram on the following page is based on the Suggested Course Outline Structure. It graphically illustrates the points in the Machine Shop program where the student should have acquired the competencies necessary for entry level employment into the job classifications indicated. In many cases by the time a student reaches an exit point he/she may have acquired several competencies in addition to those required for the specific job classification.

The course outline is structured to prepare students to become Grinder Operators, Drill Press Operators, Milling Machine Operators, Lathe Operators and Machinists. Every student, upon leaving a vocational program, should have entry level skills in some related occupation.

The Task Listing by DOT Code indicates the entry level skills (tasks) required for the student to be considered employable in a specified occupation. If the local program is individualized it should be relatively easy to move a potential program leaver (drop out) into those skills (tasks) which would qualify the student for one of the listed occupations.

EXIT POINTS

MACHINE SHOP


Start Program
End 1st Quarter
End 2nd Quarter
Drill Press Operator 606.682-014
Lathe Operator 604.685-026
End 3rd Quarter
End 4th Quarter
Milling Machine Operator 605.685-030
Grinder Operator 603.280-018
Machinist 600.280-022

TASK LISTING BY D.O.T. CODE

In this section the occupational exit points from the curriculum are cross referenced with the tasks which are required for employment in each job title. On the line following each task an x appears in the column of each job title to which the task applies. All the tasks listed in this matrix are taught in the curriculum presented in this guide. A detailed treatment of each task appears in the Unit Guides section of this curriculum guide.

TASK LISTING BY DOT CODE

MACHINE SHOP

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Grinder Operator	Drill Press Operator	Milling Machine Operator	Lathe Operator	Machinist	
	DOT DESCRIPTIONS	Grinder Operator	Drill Press Operator	Milling Machine Operator	Lathe Operator	Machinist	
	DOT NO.	603.280-018	606.682-014	605.685-030	604.685-026	600.280-022	
	Duty A: Bench Work						
MS-01	Laying out metal surfaces	X	X	X	X	X	
MS-02	Identifying jig buttons	X	X	X	X	X	
MS-03	Using the sine bar	X	X	X	X	X	
MS-04	Using the bevel protractor	X	X	X	X	X	
MS-05	Using steel rules	X	X	X	X	X	
MS-06	Using the micrometer	X	X	X	X	X	
MS-07	Reading a Vernier scale	X	X	X	X	X	
MS-08	Using dial indicators, center testers and speed indicators	X	X	X	X	X	
MS-09	Using precision gage blocks, tapered ring, plug and snap gages	X	X	X	X	X	
MS-10	Identifying and using hand hacksaws	X	X	X	X	X	
MS-11	Using abrasives and lapping compounds	X	X	X	X	X	
MS-12	Identifying and using files	X	X	X	X	X	
MS-13	Scraping flat and curved bearing surfaces	X	X	X	X	X	
MS-14	Using hammers and screwdrivers for hand bench use	X	X	X	X	X	
MS-15	Identifying and using wrenches	X	X	X	X	X	
MS-16	Using bench vices and clamps	X	X	X	X	X	

TASK LISTING BY DOT CODE

MACHINE SHOP

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT DESCRIPTIONS DOT NO.	Grinder Operator 603.280-018	Drill Press Operator 606.682-014	Milling Machine Operator 605.685-030	Lathe Operator 604.685-026	Machinist 600.280-022	
MS-17	Identifying and using chipping tools		X	X	X	X	X	
MS-18	Using hand taps, dies and hand reamers		X	X	X	X	X	
MS-19	Identifying power tool safety practices		X	X	X	X	X	
MS-20	Assembling and pitting		X	X	X	X	X	
MS-21	Identifying fasteners		X	X	X	X	X	
MS-22	Using thread, center, fillet and radius gages		X	X	X	X	X	
MS-23	Identifying lubricants and greases		X	X	X	X	X	
MS-24	Performing machine maintenance		X	X	X	X	X	
MS-25	Identifying bench work safety		X	X	X	X	X	
	Duty B: Drilling Machine Work							
MS-26	Identifying parts and functions of the drilling machine			X			X	
MS-27	Identifying safety practices and precautions when using the drilling machine			X			X	
MS-28	Identifying work-holding devices and set ups			X			X	
MS-29	Identifying and using drill bit holding devices			X			X	
MS-30	Identifying drill bits			X			X	
MS-31	Identifying cutting feeds and speeds			X			X	
MS-32	Identifying principles of straight drilling			X			X	

TASK LISTING BY DOT CODE

MACHINE SHOP

POSSIBLE EXIT POINTS

	DOT DESCRIPTIONS	Grinder Operator	Drill Press Operator	Milling Machine Operator	Lathe Operator	Machinist	
	DOT NO.	603.280-018	606.682-014	605.685-030	604.685-026	600.280-022	
TASK NO.	TASK NAME						
MS-33	Identifying and using coolants and cutting compounds		X			X	
MS-34	Grinding and care of drills		X			X	
MS-35	Identifying and using twist drill gages		X			X	
MS-36	Identifying and using drill grinding machines		X			X	
MS-37	Identifying machine reamers		X			X	
MS-38	Machine reaming		X			X	
MS-39	Identifying principles of boring and counterboring		X			X	
MS-40	Spot facing		X			X	
MS-41	Counter sinking, center drilling, and tapping		X			X	
	Duty C: Engine Lathe Work						
MS-42	Identifying lathe safety				X	X	
MS-43	Identifying lathes				X	X	
MS-44	Identifying work-holding devices				X	X	
MS-45	Identifying cutting tools				X	X	
MS-46	Identifying measuring tools				X	X	
MS-47	Identifying lathe attachments				X	X	

TASK LISTING BY DOT CODE

MACHINE SHOP

	POSSIBLE EXIT POINTS DOT DESCRIPTIONS	Grinder Operator	Drill Press Operator	Milling Machine Operator	Lathe Operator	Machinist	
	DOT NO.	603.280-018	606.682-014	605.685-030	604.685-026	600.280-022	
TASK NO.	TASK NAME						
MS-48	Calculating cutting feeds and speeds on the lathe				X	X	
MS-49	Determining RPM				X	X	
MS-50	Centering stock				X	X	
MS-51	Identifying principles of facing				X	X	
MS-52	Identifying principles of straight turning and turning to shoulders				X	X	
MS-53	Identifying checks				X	X	
MS-54	Form turning				X	X	
MS-55	Identifying face plate work				X	X	
MS-56	Using draw-in collets				X	X	
MS-57	Identifying principles of drilling				X	X	
MS-58	Identifying machine reamers				X	X	
MS-59	Reaming on the engine lathe				X	X	
MS-60	Boring on the engine lathe				X	X	
MS-61	Identifying and using mandrels				X	X	
MS-62	Knurling on the engine lathe				X	X	
MS-63	Cutting off on the engine lathe				X	X	
MS-64	Identifying thread cutting devices				X	X	
MS-65	Identifying the parts of a thread				X	X	

TASK LISTING BY DOT CODE

MACHINE SHOP

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Grinder Operator	Drill Press Operator	Milling Machine Operator	Lathe Operator	Machinist	
	DOT DESCRIPTIONS / DOT NO.	603.280-018	606.682-014	605.685-030	604.685-026	600.280-022	
MS-66	Identifying American National Thread standards				X	X	
MS-67	Computing American National Thread form				X	X	
MS-68	Computing sharp V-thread formulas				X	X	
MS-69	Identifying acme threads				X	X	
MS-70	Using the acme tap				X	X	
MS-71	Identifying square threads				X	X	
MS-72	Identifying classes of fits of screw threads				X	X	
MS-73	Using threads gages				X	X	
MS-74	Using a thread micrometer				X	X	
MS-75	Measuring threads with the three-wire method				X	X	
MS-76	Cutting threads with an even geared lathe				X	X	
MS-77	Cutting threads on a lathe which is not even geared				X	X	
MS-78	Cutting threads on a quick-change gear lathe				X	X	
MS-79	Identifying multiple lead screw threads				X	X	
MS-80	Cutting left hand threads				X	X	
MS-81	Determining a tap drill size				X	X	
MS-82	Cutting interval threads and tapping				X	X	
MS-83	Identifying principles of taper turning				X	X	
MS-84	Computing tapers				X	X	

TASK LISTING BY DOT CODE

MACHINE SHOP

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT DESCRIPTIONS / DOT NO. Grinder Operator 603.280-018	Drill Press Operator 606.682-014	Milling Machine Operator 605.685-030	Lathe Operator 604.685-026	Machinist 600.280-022	
MS-85	Measuring short tapers				X	X	
MS-86	Gaging inside and outside tapers				X	X	
MS-87	Tapering by the offset tail stock methods				X	X	
MS-88	Cutting a taper with the compound rest				X	X	
MS-89	Cutting a taper with the taper attachment				X	X	
MS-90	Boring or turning interval tapers				X	X	
MS-91	Identifying coolants and cutting compounds				X	X	
MS-92	Identifying lubricants				X	X	
	Duty D: Turret Lathe Work						
MS-93	Identifying turret lathes				X	X	
MS-94	Identifying turret lathe safety practices				X	X	
MS-95	Maintaining the turret lathe				X	X	
MS-96	Identifying work holding devices				X	X	
MS-97	Identifying chucking operations on the turret						
	lathe				X	X	
MS-98	Identifying special fixtures and steady rests				X	X	
MS-99	Identifying standard tool holding devices				X	X	
MS-100	Identifying principles of tool grinding				X	X	

TASK LISTING BY DOT CODE

MACHINE SHOP

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Grinder Operator	Drill Press Operator	Milling Machine Operator	Lathe Operator	Machinist	
	DOT DESCRIPTIONS / DOT NO.	603.280-018	606.682-014	605.685-030	604.685-026	600.280-022	
MS-101	Selecting cutting speed and feed on the turret lathe				X	X	
MS-102	Identifying coolants and cutting compounds				X	X	
MS-103	Facing on the turret lathe				X	X	
MS-104	Using face plates				X	X	
MS-105	Forming on the turret lathe				X	X	
MS-106	Turning on the turret lathe				X	X	
MS-107	Drilling on the turret lathe				X	X	
MS-108	Boring on the turret lathe				X	X	
MS-109	Reaming on the turret lathe				X	X	
MS-110	Taper turning on the turret lathe				X	X	
MS-111	Chamfering and grooving on the turret lathe				X	X	
MS-112	Threading on the turret lathe				X	X	
	Duty E: Power Saw Work						
MS-113	Identifying power cut-off saws					X	
MS-114	Identifying power saw safety					X	
MS-115	Identifying and using work holding devices on the power cut-off saw					X	

TASK LISTING BY DOT CODE

MACHINE SHOP

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Grinder Operator	Drill Press Operator	Milling Machine Operator	Lathe Operator	Machinist	
	DOT DESCRIPTIONS / DOT NO.	603.280-018	606.682-014	605.685-030	604.685-026	600.280-022	
MS-116	Identifying, selecting, mounting and maintaining saw blades					X	
MS-117	Identifying speeds, feeds and coolants for power cut-off saws					X	
MS-118	Using the power cut-off saw for straight and angular sawing					X	
MS-119	Identifying the metal band saw					X	
MS-120	Identifying coolants and lubricating agents for band saws					X	
MS-121	Choosing saw blades for the metal band saw					X	
MS-122	Calculating feeds and speeds for the metal band saw					X	
	Duty F: Shaper Work						
MS-123	Identifying types, sizes, construction, specifications, nomenclature and range of work for shapers						
MS-124	Identifying shaper work holding devices and their function					X	

TASK LISTING BY DOT CODE

MACHINE SHOP

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT DESCRIPTIONS DOT NO.	Grinder Operator 603.280-018	Drill Press Operator 606.682-014	Milling Machine Operator 605.685-030	Lathe Operator 604.685-026	Machinist 600.280-022	
MS-125	Identifying shaper cutting tools, grinding them and attaching to machine						X	
MS-126	Setting up the shaper and calculating speed and feed						X	
MS-127	Adjusting the shaper						X	
MS-128	Performing a horizontal shaping operation						X	
MS-129	Performing a vertical shaping operation						X	
MS-130	Shaping a rectangle or square						X	
MS-131	Shaping a contour						X	
MS-132	Performing angular shaping and dovetailing operations						X	
MS-133	Cutting internal and external slots and keyways and cutting off in the shaper						X	
MS-134	Maintaining and caring for the shaper						X	
	Duty G: Planer Work							
MS-135	Identifying types, sizes, construction, specifications, nomenclature and range of work for planers						X	

TASK LISTING BY DOT CODE

MACHINE SHOP

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT DESCRIPTIONS: Grinder Operator DOT NO.: 603.280-018	Drill Press Operator 606.682-014	Milling Machine Operator 605.685-030	Lathe Operator 604.685-026	Machinist 600.280-022	
MS-136	Identifying and using work holding and clamping devices					X	
MS-137	Identifying planer cutting tools, grinding them and attaching to machine					X	
MS-138	Setting up the planer and calculating speed and feed					X	
MS-139	Performing planing operations					X	
MS-140	Maintaining and caring for the planer					X	
	Duty H: Milling Machine Work						
MS-141	Identifying types, sizes, construction, specifications, nomenclature and range of work for milling machines			X		X	
MS-142	Identifying milling machine work holding devices and their function			X		X	
MS-143	Identifying, selecting and aligning milling machine attachments			X		X	
MS-144	Selecting and setting up milling machine cutters and holders			X		X	

TASK LISTING BY DOT CODE

MACHINE SHOP

		POSSIBLE EXIT POINTS					
		DOT DESCRIPTIONS	Grinder Operator	Drill Press Operator	Milling Machine Operator	Lathe Operator	Machinist	
TASK NO.	TASK NAME	DOT NO.	603.280-018	606.682-014	605.685-030	604.685-026	600.280-022	
MS-145	Calculating cutting speeds and feeds for milling machine work				X		X	
MS-146	Performing a plain milling operation				X		X	
MS-147	Performing a face milling operation				X		X	
MS-148	Performing a side milling operation				X		X	
MS-149	Performing a form milling operation				X		X	
MS-150	Performing an angular milling operation				X		X	
MS-151	Performing an end milling operation				X		X	
MS-152	Performing a gang milling operation				X		X	
MS-153	Drilling, boring and reaming with the milling machine				X		X	
MS-154	Performing sawing, slitting and cutting off operations with the milling machine				X		X	
MS-155	Performing keyseating and T-slot milling operations				X		X	
MS-156	Performing indexing operations				X		X	
MS-157	Performing circular milling operations				X		X	
MS-158	Performing graduating and marking operations				X		X	
MS-159	Performing profiling				X		X	
MS-160	Maintaining and caring for the milling machine				X		X	

TASK LISTING BY DOT CODE

MACHINE SHOP

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT DESCRIPTIONS: Grinder Operator DOT NO.: 603.280-018	Drill Press Operator 606.682-014	Milling Machine Operator 605.685-030	Lathe Operator 604.685-026	Machinist 600.280-022	
	Duty I: Gears and Gearing						
MS-161	Identifying types of gears and their function			X		X	
MS-162	Identifying gear tooth elements and their symbols			X		X	
MS-163	Calculating the pitch, diameters, working depth and clearances for machining gears			X		X	
MS-164	Milling a spur gear			X		X	
MS-165	Milling a gear rack			X		X	
MS-166	Milling a stub gear			X		X	
MS-167	Milling a bevel gear			X		X	
MS-168	Machining a worm gear on the engine lathe			X		X	
	Duty J: Grinder Work						
MS-169	Identifying grinders, grinding wheels and attachments	X				X	
MS-170	Using the bench grinder	X				X	
MS-171	Using the surface grinder	X				X	
MS-172	Using the cylindrical grinder	X				X	
MS-173	Using the tool and cutter grinder	X				X	
MS-174	Using the centerless grinder	X				X	

TASK LISTING BY DOT CODE

MACHINE SHOP

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT DESCRIPTIONS: Grinder Operator DOT NO.: 603.280-018	Drill Press Operator 606.682-014	Milling Machine Operator 605.685-030	Lathe Operator 604.685-026	Machinist 600.280-022	
MS-175	Performing honing and lapping operations	X				X	
	Duty K: Metallurgy						
MS-176	Identifying metal manufacturing processes					X	
MS-177	Identifying the physical structure of metals					X	
MS-178	Identifying properties of metals					X	
MS-179	Identifying methods of heat treatment					X	
MS-180	Identifying iron manufacturing processes					X	
MS-181	Identifying processes used to produce steel					X	
MS-182	Identifying processes used to produce copper, brass, and bronze alloys					X	
MS-183	Identifying processes used to produce aluminum					X	
MS-184	Identifying processes for the production of magnesium and titanium					X	

SECTION IV

CURRICULUM STRUCTURE & COURSE OUTLINE

CURRICULUM STRUCTURE

The following example of a curriculum structure is provided to illustrate one way a Machine Shop curriculum may be structured. The example is not intended to imply that there are not other ways to structure the curriculum.

This curriculum structure is based on the Suggested Course Outline that follows and is an example of successful Machine Shop programs in Georgia and other states. The actual amount of time required for each course will vary according to local program objectives and depend upon the instructor, the student, projects attempted and facilities available.

Instructors are encouraged to structure their curriculum and make time estimates based on their experiences, industry requirements, student's needs and the local facilities (classroom, equipment, lab) available.

The clock hours listed include instructional time in both the classroom and lab. The additional project hours are an approximation of the amount of time students could spend on the Machine Shop projects outlined in Section V-a. These projects should not be assigned until all prerequisite tasks have been satisfactorily completed.

MACHINE SHOP CURRICULUM STRUCTURE

Course Number	Course	Clock Hours
	Quarter I	
	Bench Work	39½
	Drilling Machine Work	19½
	Engine Lathe Work	128
	Machine Shop Projects	125
		312
	Quarter II	
	Turret Lathe Work	58
	Power Saw Work	20
	Shaper Work	56½
	Planer Work	34
	Milling Machine Work	32
	Machine Shop Projects	111½
		312
	Quarter III	
	Milling Machine Work	102½
	Gears and Gearing	69½
	Machine Shop Projects	140
		312
	Quarter IV	
	Grinder Work	92½
	Metallurgy	170
	Machine Shop Projects	49½
		312

COURSE OUTLINE

The following sample quarter system outline is to be used as an example to facilitate the development of alternative outlines for the individual learner. The listing of major Duty Areas within a quarter is not to indicate a sequenced pattern. All duty areas are independent; therefore, a group of students should begin the quarter by learning different tasks. This allows better coordination of the lab hours and the learning objectives may be selected according to the type of projects or equipment available.

The time estimations for completion of the activities are based on opinions of Machine Shop instructors and published data. The estimates are a minimum amount of time required and should be extended according to the learner's individual needs. The additional project hours is an approximation of the amount of time the student should spend on work projects. A cross reference of Georgia Machine Shop Projects and the Duty Areas is presented in Section V-a.

Machine Shop Suggested Course Outline

Quarter I

Unit/Task	Title	Classroom and Laboratory Hours
	Duty A - Bench Work	
MS-01	Laying out metal surfaces	4
MS-02	Identifying jig buttons	4
MS-03	Using the sine bar	2½
MS-04	Using the bevel protractor	2½
MS-05	Using steel rules	1
MS-06	Using the micrometer	1½
MS-07	Reading a Vernier scale	2
MS-08	Using dial indicators, center testers and speed indicators	1½
MS-09	Using precision gage blocks, tapered ring, plug and snap gages	1½
MS-10	Identifying and using hand hacksaws	½
MS-11	Using abrasives and lapping compounds	1½
MS-12	Identifying and using files	½
MS-13	Scraping flat and curved bearing surfaces	2
MS-14	Using hammers and screwdrivers for hand bench use	½
MS-15	Identifying and using wrenches	½
MS-16	Using bench vices and clamps	½
MS-17	Identifying and using chipping tools	1
MS-18	Using hand taps, dies and hand reamers	3
MS-19	Identifying power tool safety practices	½
MS-20	Assembling and pitting	2½
MS-21	Identifying fasteners	1
MS-22	Using thread, center, fillet and radius gages	1
MS-23	Identifying lubricants and greases	1
MS-24	Performing machine maintenance	2
MS-25	Identifying bench work safety	1
		39½
	Duty B - Drilling Machine Work	
MS-26	Identifying parts and functions of the drilling machine	1
MS-27	Identifying safety practices and precautions when using the drilling machine	1
MS-28	Identifying work-holding devices and setups	1
MS-29	Identifying and using drill bit holding devices	½

Unit/Task	Title	Classroom and Laboratory Hours
MS-30	Identifying drill bits	1
MS-31	Identifying cutting feeds and speeds	1½
MS-32	Identifying principles of straight drilling	2
MS-33	Identifying and using coolants and cutting compounds	1½
MS-34	Grinding and care of drills	1½
MS-35	Identifying and using twist drill gages	1½
MS-36	Identifying and using drill grinding machines	1
MS-37	Identifying machine reamers	2
MS-38	Machine reaming	1
MS-39	Identifying principles of boring and counterboring	1½
MS-40	Spot facing	½
MS-41	Counter sinking, center drilling, and tapping	1
		19½
	Duty C - Engine Lathe Work	
MS-42	Identifying lathe safety	2
MS-43	Identifying lathes	2
MS-44	Identifying work-holding devices	1½
MS-45	Identifying cutting tools	1½
MS-46	Identifying measuring tools	1
MS-47	Identifying lathe attachments	1
MS-48	Calculating cutting feeds and speeds on the lathe	3
MS-49	Determining RPM	2
MS-50	Centering stock	2
MS-51	Identifying principles of facing	1½
MS-52	Identifying principles of straight turning and turning to shoulders	3
MS-53	Identifying checks	1½
MS-54	Form turning	2
MS-55	Identifying face plate work	3½
MS-56	Using draw-in collets	2
MS-57	Identifying principles of drilling	1
MS-58	Identifying machine reamers	1
MS-59	Reaming on the engine lathe	1
MS-60	Boring on the engine lathe	3½
MS-61	Identifying and using mandrels	2½
MS-62	Knurling on the engine lathe	1½
MS-63	Cutting off on the engine lathe	1½
MS-64	Identifying thread cutting devices	2½
MS-65	Identifying the parts of a thread	1½
MS-66	Identifying American National Thread standards	1½
MS-67	Computing American National Thread form	2½
MS-68	Computing sharp V-thread formulas	3

Unit/Task	Title	Classroom and Laboratory Hours
MS-69	Identifying acme threads	3
MS-70	Using the acme tap	2½
MS-71	Identifying square threads	3
MS-72	Identifying classes of fits of screw threads	2
MS-73	Using threads gages	2½
MS-74	Using a thread micrometer	2½
MS-75	Measuring threads with the three-wire method	2
MS-76	Cutting threads with an even geared lathe	4
MS-77	Cutting threads on a lathe which is not even geared	4
MS-78	Cutting threads on a quick-change gear lathe	3
MS-79	Identifying multiple lead screw threads	3½
MS-80	Cutting left hand threads	3½
MS-81	Determining a tap drill size	1½
MS-82	Cutting interval threads and tapping	5½
MS-83	Identifying principles of taper turning	5
MS-84	Computing tapers	1
MS-85	Measuring short tapers	5
MS-86	Gaging inside and outside tapers	4
MS-87	Tapering by the offset tail stock methods	2
MS-88	Cutting a taper with the compound rest	4
MS-89	Cutting a taper with the taper attachment	4
MS-90	Boring or turning interval tapers	4
MS-91	Identifying coolants and cutting compounds	2
MS-92	Identifying lubricants	2
		128

Quarter I Classroom and Lab Hours:	187
Quarter I Project Hours:	125
Total Quarter Hours:	312

Quarter II

Unit/Task	Title	Classroom and Laboratory Hours
	Duty D - Turret Lathe Work	
MS-93	Identifying turret lathes	3
MS-94	Identifying turret lathe safety practices	2
MS-95	Maintaining the turret lathe	2
MS-96	Identifying work holding devices	2
MS-97	Identifying chucking operations on the turret lathe	2
MS-98	Identifying special fixtures and steady rests	4
MS-99	Identifying standard tool holding devices	1
MS-100	Identifying principles of tool grinding	4
MS-101	Selecting cutting speed and feed on the turret lathe	3
MS-102	Identifying coolants and cutting compounds	2
MS-103	Facing on the turret lathe	2
MS-104	Using face plates	3
MS-105	Forming on the turret lathe	4
MS-106	Turning on the turret lathe	5
MS-107	Drilling on the turret lathe	3
MS-108	Boring on the turret lathe	4
MS-109	Reaming on the turret lathe	3
MS-110	Taper turning on the turret lathe	2
MS-111	Chamfering and grooving on the turret lathe	3
MS-112	Threading on the turret lathe	4
		58
	Duty E - Power Saw Work	
MS-113	Identifying power cut-off saws	2
MS-114	Identifying power saw safety	1
MS-115	Identifying and using work holding devices on the power cut-off saw	4
MS-116	Identifying, selecting, mounting and maintaining saw blades	1
MS-117	Identifying speeds, feeds and coolants for power cut-off saws	2
MS-118	Using the power cut-off saw for straight and angular sawing	2
MS-119	Identifying the metal band saw	2
MS-120	Identifying coolants and lubricating agents for band saws	2
MS-121	Choosing saw blades for the metal band saw	2

Unit/Task	Title	Classroom and Laboratory Hours
MS-122	Calculating feeds and speeds for the metal band saw	2
		20
	Duty F - Shaper Work	
MS-123	Identifying types, sizes, construction, specifications, nomenclature and range of work for shapers	6
MS-124	Identifying shaper work holding devices and their function	4
MS-125	Identifying shaper cutting tools, grinding them and attaching to machine	4
MS-126	Setting up the shaper and calculating speed and feed	8
MS-127	Adjusting the shaper	5½
MS-128	Performing a horizontal shaping operation	5
MS-129	Performing a vertical shaping operation	5
MS-130	Shaping a rectangle or square	4
MS-131	Shaping a contour	3½
MS-132	Performing angular shaping and dovetailing operations	5
MS-133	Cutting internal and external slots and keyways and cutting off in the shaper	5
MS-134	Maintaining and caring for the shaper	1½
		56½
	Duty G - Planer Work	
MS-135	Identifying types, sizes, construction, specifications, nomenclature and range of work for planers	10
MS-136	Identifying and using work holding and clamping devices	3
MS-137	Identifying planer cutting tools, grinding them and attaching to machine	8½
MS-138	Setting up the planer and calculating speed and feed	6
MS-139	Performing planing operations	4½
MS-140	Maintaining and caring for the planer	2
		34

Unit/Task	Title	Classroom and Laboratory Hours
	Duty H - Milling Machine Work	
MS-141	Identifying types, sizes, construction, specifications, nomenclature and range of work for milling machines	8
MS-142	Identifying milling machine work holding devices and their function	3
MS-143	Identifying, selecting and aligning milling machine attachments	8
MS-144	Selecting and setting up milling machine cutters and holders	10
MS-145	Calculating cutting speeds and feeds for milling machine work	3
		32

Quarter II Classroom and Lab Hours: 200½
Quarter II Project Hours: 111½

Total Quarter Hours: 312

Quarter III

Duty H - Milling Machine Work (con't)

Unit/Task	Title	Classroom and Laboratory Hours
MS-146	Performing a plain milling operation	10
MS-147	Performing a face milling operation	4
MS-148	Performing a side milling operation	5
MS-149	Performing a form milling operation	10
MS-150	Performing an angular milling operation	4
MS-151	Performing an end milling operation	3½
MS-152	Performing a gang milling operation	5
MS-153	Drilling, boring and reaming with the milling machine	12
MS-154	Performing sawing, slitting and cutting off operations with the milling machine	6
MS-155	Performing keyseating and T-slot milling operations	10
MS-156	Performing indexing operations	12
MS-157	Performing circular milling operations	6
MS-158	Performing graduating and marking operations	4
MS-159	Performing profiling	8
MS-160	Maintaining and caring for the milling machine	3
		102½

Duty I - Gears and Gearing

Unit/Task	Title	Classroom and Laboratory Hours
MS-161	Identifying types of gears and their function	10
MS-162	Identifying gear tooth elements and their symbols	6
MS-163	Calculating the pitch, diameters, working depth and clearances for machining gears	8
MS-164	Milling a spur gear	6½
MS-165	Milling a gear rack	10
MS-166	Milling a stub gear	8
MS-167	Milling a bevel gear	9
MS-168	Machining a worm gear on the engine lathe	12
		69½

Quarter III Classroom and Lab Hours:	172
Quarter III Project Hours:	140
Total Quarter Hours:	312

Quarter IV

Unit/Task	Title	Classroom and Laboratory Hours
	Duty J - Grinder Work	
MS-169	Identifying grinders, grinding wheels and attachments	10
MS-170	Using the bench grinder	6
MS-171	Using the surface grinder	10
MS-172	Using the cylindrical grinder	28
MS-173	Using the tool and cutter grinder	20
MS-174	Using the centerless grinder	15
MS-175	Performing honing and lapping operations	3½
		92½
	Duty K - Metallurgy	
MS-176	Identifying metal manufacturing processes	30
MS-177	Identifying the physical structure of metals	20
MS-178	Identifying properties of metals	22
MS-179	Identifying methods of heat treatment	10
MS-180	Identifying iron manufacturing processes	12
MS-181	Identifying processes used to produce steel	16
MS-182	Identifying processes used to produce copper, brass, and bronze alloys	18
MS-183	Identifying processes used to produce aluminum	22
MS-184	Identifying processes for the production of magnesium and titanium	20
		170
	Quarter IV Classroom and Lab Hours:	262½
	Quarter IV Project Hours:	49½
	Total Quarter Hours:	312

SECTION V

UNIT GUIDES

UNIT GUIDES

Description

In this section the tasks to be taught in each course are presented in sequential order. Each task is listed on a separate page so that it may be taken out of the guide for daily lesson planning or regrouped with other tasks to fit the individual teacher's own preference for teaching order. The task pages may be used for planning and executing group instruction or for individualized instruction. Each page in the UNIT GUIDES section contains the following information:

TASK: This is a short and concise statement of the task to be taught.

PERFORMANCE OBJECTIVE: The performance expected of the student after completing the unit is stated in stem form, without a specific statement of all conditions, equipment, and performance standard (these are listed in a criterion referenced measure in the Evaluation section of the task page).

INSTRUCTIONAL ACTIVITIES: Suggested learning activities are presented. These activities include providing information, demonstration, practical applications, and related instruction.

INSTRUCTIONAL MATERIALS: The materials that are necessary to carry out the instructional activities are listed. These include textbooks, audio-visuals and equipment. Textbooks are referenced by author with the title of the book contained in the textbook list in the

Instructional Resource section. In the event of more than one textbook per author then the textbook reference will be numbered.

EVALUATION: This section contains a criterion referenced measure and reference to any test items or other evaluation measures that are available to the teacher. V'TECS catalogs are cross referenced to each program task by task number.

CLASSROOM HOURS: The estimated time for completion of the instructional activities and the evaluation are indicated. This time estimate is stated in hours of classroom time but also includes shop hours.

TASK

MS-01 Laying out metal surfaces

PERFORMANCE OBJECTIVE

Layout a metal surface by marking or scribing center points, circles, arc, or straight lines.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tools used for laying out and scribing lines
b. Scribers
    1. Construction
    2. Keeping the point sharp
c. Kinds of mixtures which produce a white coating
d. Copper sulphate solution
e. Blueing a steel surface
f. Cleanliness
g. Laying out angular lines
h. Grinding points of punches
    1. Center punch
    2. Prick punch
i. Using dividers

(Continued on back)

Provide Demonstration On:

a. Marking a metal surface
b. Scribing a metal surface
c. Locating the center point on round stock

Provide Practical Application On:

a. Use a scriber to mark a circle, arc and straight. line on a metal surface
b. Locate and mark the center point on round stock.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Porter

A/Vs:

a. Bergwall, Filmstrip #505, "Bench Metal Work"
b. Prentice-Hall, Filmstrip #VD930-1, "Machine Shop: Bench Operations"

Student Manuals:

Ohio, Machine Trades I, Bench-Work Assignment Sheet #1

Tools and Equipment:

a. Scribing tools
b. Marking supplies
c. American Machinist's Handbook
d. Machinery Handbook

CLASSROOM HOURS 4

EVALUATION (MS-01)

a. Given appropriate tools, supplies and equipment, the student will accurately layout metal work by scribing or marking circles, arcs and straight lines and marking the center point of round stock.

b. V'TECS, Machine Shop, Task No. 22.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

k. Surface plate
l. Use of Vee blocks
m. Centering round stock
    1. Methods
    2. Tools used

TASK

MS-02 Identifying jig buttons

PERFORMANCE OBJECTIVE

Identify the purpose of jig buttons and the method of spacing holes in circles.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Jig buttons
    1. Purpose
    2. Location on the work
    3. Instruments used to set buttons
    4. Tightening the screws
b. Using the parallel and micrometer
c. Using the height gauge
d. When jig buttons are removed
e. Laying out equally spaced holes on a circle

Provide Demonstration On:

a. Setting jig buttons
b. Laying out equally spaced holes on a circle

Provide Practical Application On:

a. Locating and setting jig buttons
b. Layout equally spaced holes on a circle

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #2

Tools and Equipment:

a. American Machinist's Handbook
b. Jig button
c. Screw
d. Washer
e. Parallel
f. Micrometer
g. Height gauge

CLASSROOM HOURS

4

EVALUATION (MS-02)

Given appropriate tools, supplies and equipment, the student will be able to layout and correctly set jig buttons and be able to accurately layout equally spaced holes in a given size circle.

TASK

MS-03 Using the sine bar

PERFORMANCE OBJECTIVE

Use the sine bar to check angles, bevels and tapers pertaining to templates, gauges and other angular work.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sine bar
   1. Purpose
   2. Method of use
   3. Construction (Kind of steel)
b. Sine bar application
   1. Items that can be checked
   2. Jo-block
c. Trigonometric functions
   1. Formula
   2. Right triangle
d. Adjustable angle plates

Provide Demonstration On:

a. Using the trigonometry formula for setting the sine bar
b. Measuring an angle with the sine bar

Provide Practical Application On:

a. Sketch a surface plate with a two inch Jo-block and an angle plate mounted with a five inch sine bar.
b. Measure an angle using the sine bar.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Porter

A/Vs:

Bergwall, Filmstrip #503-5, "Measuring Tools Explained"

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #3
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. American Machinist's Handbook
b. Machinery's Handbook
c. Sine bar
d. Jo-blocks

CLASSROOM HOURS

2½

EVALUATION (MS-03)

a. Given an assigned measurement, the student will be able to accurately measure an angle using the sine bar. The instructor will check the student's results for accuracy.

b. V-TECS, Machine Shop, Task No. 40.

TASK

MS-04 Using the bevel protractor

PERFORMANCE OBJECTIVE

Use a bevel protractor to make an assigned relative measurement.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Bevel protractor
    1. Application
    2. Maximum revolution
    3. Valve of the divisions on the vernier scale
    4. Maximum reading on the scale

b. Measuring angles greater than 90°

Provide Demonstration On:

a. Reading the scale on a bevel protractor

b. Making a greater than 90° measurement

Provide Practical Application On:

a. Measure an angle and read the scale on the bevel protractor

b. Measure an angle which is greater than 90°

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I

b. Kibbe

c. Porter

A/Vs:

Bergwall, Filmstrip #503, "Measuring Tools Explained"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #4

Tools and Equipment:

Bevel protractor

CLASSROOM HOURS

2½

EVALUATION (MS-04)

Given a bevel protractor and an assigned measurement, the student will be able to accurately read the measurement. The measurement may be of an angle which is greater than 90°.

TASK

MS-05 Using steel rules

PERFORMANCE OBJECTIVE

Use steel rules to make measurements.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of steel rules
b. Types of scales on the rule
c. Reading the scales
d. Using a short length rule
e. Adding fractions
f. Reducing a fraction to lowest terms

Provide Demonstration On:

a. Using a short length rule
b. Adding fractions
c. Reducing fractions to lowest terms

Provide Practical Application On:

Use a steel rule to make an assigned measurement.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #505-1, "Bench Metal Work"
b. Prentice-Hall, Filmstrip #VD930-1, "Machine Shop: Bench Operations"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #5

Tools and Equipment:

Steel ruler

CLASSROOM HOURS

1

EVALUATION (MS-05)

Given a steel rule and an assigned measurement, the student will be able to make the measurement to an accuracy of 1/64 inch and reduce the fractional reading to lowest terms. The instructor will check the student's reading.

TASK

MS-06 Using the micrometer

PERFORMANCE OBJECTIVE

Identify types and be able to use micrometers to measure inside and outside diameters, threads, depth of holes and surfaces.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of micrometers
    1. Screw thread micrometer
    2. Outside micrometer
    3. Inside micrometer
    4. Micrometer depth gages
b. Care and maintenance of micrometers
c. Using micrometers
d. Temperature factors
e. Parts of a standard micrometer

Provide Demonstration On:

Using a micrometer to measure outside diameter, inside diameter

Provide Practical Application On:

Name the standard parts of a micrometer.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, Filmstrip #503-2,3,4, "Measuring Tools Explained"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #6

Tools and Equipment:

Micrometer

CLASSROOM HOURS

1½

EVALUATION (MS-06)

a. Given a micrometer and an assigned measurement, the student will be able to read a measurement to an accuracy of three places. The student will be able to identify and choose the appropriate micrometer to measure inside diameter, outside diameter, screw threads and depths.

b. V-TECS, Machine Shop, Task No. 19.

TASK

MS-07 Reading a vernier scale

PERFORMANCE OBJECTIVE

Be able to read a vernier scale as applied to calipers and micrometers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Divisions of the vernier scale
b. Reading a scale
c. Reading a vernier micrometer
    1. Vernier reading
    2. Thimble reading

Provide Demonstration On:

a. Reading a vernier caliper
b. Reading a vernier micrometer

Provide Practical Application On:

Make assigned measurements with a vernier caliper and a vernier micrometer.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, Filmstrip #503-1, "Measuring Tools Explained"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #7

Tools and Equipment:

a. Calipers (vernier)
b. Micrometers (vernier)

CLASSROOM HOURS	2

EVALUATION (MS-07)

Given a vernier caliper and a vernier micrometer, the student will be able to make assigned measurements and read the scales to an accuracy of four places.

TASK

MS-08 Using dial indicators, center testers and speed indicators

PERFORMANCE OBJECTIVE

Use a dial indicator, center tester and speed indicator in bench work to set up and inspect work for roundness, concentricity, straight and parallel surfaces.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Dial indicators
b. Center testers
c. Speed indicators
d. The center punch mark
e. Types of graduations found on a dial indicator

Provide Demonstration On:

a. Using a dial indicator
b. Using a center tester
c. Using a speed indicator

Provide Practical Application On:

Use a dial indicator, center tester and speed indicator to set up and inspect work for roundness, concentricity, straight and parallel surfaces.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, Filmstrip #503-5, "Measuring Tools Explained"

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #8
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. American Machinist's Handbook
b. Dial indicators
c. Wigglers on center finders
d. Speed indicators

CLASSROOM HOURS

1½

EVALUATION (MS-08)

a. Given a dial indicator, center tester and speed indicator, the student will use these instruments correctly to set up and inspect work for roundness, concentricity, straight and parallel surfaces.

b. V'TECS, Machine Shop, Task No. 36.

TASK

MS-09 Using precision gage blocks, tapered ring, plug and snap gages

PERFORMANCE OBJECTIVE

Use precision gage blocks in making accurate measurements and using the tapered ring, plug and snap gages.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Gage blocks
  1. Description
  2. Uses
  3. Sizes
b. Using gage block combinations
c. Using gage blocks to check micrometer accuracy
d. Using a taper gage (figuring the taper)
e. Using a snap gage
  1. Sizes
  2. Tolerance

Provide Demonstration On:

a. Using gage blocks
b. Using a taper gage
c. Using plug and snap gages

Provide Practical Application On:

a. Use a combination of gage blocks to check a measurement for accuracy.
b. Use a taper gage to calculate taper.
c. Use plug and snap gages to measure a given dimension.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, Filmstrip #503-4, "Measuring Tools Explained"

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #9
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Precision gage blocks
b. Tapered ring gage
c. Plug and snap gages
d. American Machinist's Handbook
e. Micrometer

CLASSROOM HOURS 1½

EVALUATION (MS-09)

a. Given an assigned series of measurements, the student will be able to properly use gage blocks, a taper gage, plug and snap gages to make accurate measurements according to proper procedure.

v. V'TECS, Machine Shop, Task No. 37 and 38.

TASK

MS-10 Identifying and using hand hacksaws

PERFORMANCE OBJECTIVE

Identify and be able to use hand hacksaws including types and sizes of blades.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Testing a material with a file prior to sawing
b. Saw blades
    1. Teeth-per-inch
    2. Types
    3. Tightening a blade
    4. Types, sizes
c. Using the vise (Using pieces of wood for chips, pieces)
d. Layout line

Provide Demonstration On:

a. Installing a hacksaw blade
b. Using a hacksaw

Provide Practical Application On:

Choose a hacksaw blade, install it on a saw and cut an assigned piece of material.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #505-2, "Bench Metal Work"
b. Prentice-Hall, Filmstrip #VD930-2, "Machine Shop: Bench Operations"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #10

Tools and Equipment:

a. Machinist's Handbook
b. Hacksaw
c. Vise
d. Hacksaw blades

CLASSROOM HOURS

½

EVALUATION (MS-10)

a. Given a hacksaw and a selection of blades, the student will be able to select and install the appropriate blade to cut an assigned piece of metal and cut the metal to a specified dimension using appropriate hand hacksaw procedure.

b. V'TECS, Machine Shop, Task No. 28 and No. 41.

TASK

MS-11 Using abrasives and lapping compounds

PERFORMANCE OBJECTIVE

Use abrasives and lapping compounds to obtain a fine, smooth surface on hard or soft metal.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Abrasives
    1. Natural types
    2. Manufactured types
b. Laps of soft materials
c. Materials used for laps
d. Scoring or grooving laps
    1. Purpose
    2. Procedure
e. Lapping flat surfaces
f. Emery cloth
g. Buffing

Provide Demonstration On:

a. Lapping a surface
b. Smoothing a surface using emery cloth

Provide Practical Application On:

a. Lap a surface.
b. Use emery cloth to smooth a metal surface.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, filmstrip #501, "The Lathe Explained"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #11

Tools and Equipment:

a. American Machinist's Handbook
b. Machinery's Handbook
c. Emery cloth
d. Lapping compound
e. Vise

CLASSROOM HOURS 1½

EVALUATION (MS-11)

Given a soft or hard metal surface, the student will be able to obtain a fine and smooth surface using abrasives and lapping compound.

TASK

MS-12 Identifying and using files

PERFORMANCE OBJECTIVE

Identify the types, sizes, selection of and be able to use files.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Single cut files
b. File teeth
c. File faces
d. 1/2 round files
e. The parts of a file
f. Double cut files

Provide Demonstration On:

Using a file

Provide Practical Application On:

Use a file on a given piece of material.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #505-3, "Bench Metal Work"
b. Prentice-Hall, Filmstrip #VD930-2, "Machine shop: Bench Operations"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #12

Tools and Equipment:

Files

CLASSROOM HOURS

½

EVALUATION (MS-12)

a. Given a piece of metal with a rough edge, the student will be able to correctly select a file and smooth the edge following correct procedure.

b. V-TECS, Machine Shop, Task No. 33.

TASK

MS-13 Scraping flat and curved bearing surfaces

PERFORMANCE OBJECTIVE

Scrape flat and curved bearing surfaces for making smooth running machine parts and surface plates.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Materials used for surface plates
b. Purpose of scraping
c. Using a straight edge for scraping
    1. Procedure
    2. Purpose
d. Scrapers
    1. Materials made of
    2. Types of
e. Marking materials used in scraping
f. Figuring the list price of cast iron surface plate

Provide Demonstration On:

a. Scraping a surface plate
b. Calculating list price of cast iron surface plate

Provide Practical Application On:

Scrape bearing surfaces to smoothness.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, Filmstrip #505-1, "Bench Metal Work"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #13

Tools and Equipment:

a. Scraper
b. Marking tools

CLASSROOM HOURS 2

EVALUATION (MS-13)

Given a bearing surface, the student will be able to choose the appropriate tools and scrape the surface to smoothness.

TASK

MS-14 Using hammers and screwdrivers for hand bench use

PERFORMANCE OBJECTIVE

Use hammers and screwdrivers for hand bench use observing all safety and maintenance procedures.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Main parts of a machinist's hammer
b. Hammer safety
c. Soft hammer heads
d. Types of hammers
e. Hammer handles
f. Screwdriver safety
g. Grinding a screwdriver
h. Choosing a screwdriver

Provide Demonstration On:

a. Tightening a hammer head
b. Grinding a screwdriver

Provide Practical Application On:

a. Use a hammer to ding a metal surface.
b. Grind a screwdriver head.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, Filmstrip #505-6, "Bench Metal Work"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #14

Tools and Equipment:

a. Hammers
b. Screwdrivers
c. Grinding wheel

CLASSROOM HOURS ½

EVALUATION (MS-14)

Given a hammer and a screwdriver, the student will be able to use the tools for an assigned task observing correct procedure and safety practices.

TASK

MS-15 Identifying and using wrenches

PERFORMANCE OBJECTIVE

Identify the types, sizes and care of and be able to use wrenches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Wrenches
   1. Types
   2. Safety
   3. Leverage
   4. Safety
b. Using an adjustable wrench
c. Holding and checking nuts
d. Check nut tightness

Provide Demonstration On:

Using wrenches
a. Open end
b. Box end
c. Adjustable
d. Spanner types

Provide Practical Application On:

Identify and use several different types of wrenches properly.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, Filmstrip #505-6, "Bench Metal Work"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #15

Tools and Equipment:

a. Wrenches
b. American Machinist's Handbook
c. Machinery's Handbook

CLASSROOM HOURS

½

EVALUATION (MS-15)

Given a selection of wrenches and an assigned nut to tighten, the student will be able to select the appropriate wrench and follow correct safety procedures to tighten the nut.

TASK

MS-16 Using bench vises and clamps

PERFORMANCE OBJECTIVE

Use the bench vise or clamps to hold materials for bench work.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of vises
b. Kinds of metals vises are made of
c. False protective jaws
d. Parts of a bench vise
e. How a vise is fastened to a bench

Provide Demonstration On:

Fastening materials in a bench vise

Provide Practical Application On:

Use a bench vise to hold material for bench work operation.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #16

Tools and Equipment:

a. Machinery's Handbook
b. Bench vise or clamps

CLASSROOM HOURS

½

EVALUATION (MS-16)

Given a material to bend, chip, polish, file or perform other bench work on, the student will be able to secure the material in a bench vise following correct procedure and all related precautions.

TASK

MS-17 Identifying and using chipping tools

PERFORMANCE OBJECTIVE

Identify and be able to use tools for chipping.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Angles between facets of a chisel
b. Types of chisels
c. Chipping guard
d. Chipping a keyway
e. Safety
f. Amount of material to leave for finishing

Provide Demonstration On:

a. Choosing a chisel for a job
b. Proper use of a chisel

Provide Practical Application On:

Use a chisel for an assigned chipping operation.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #17
b. Machine Shop Training Course, Vol. 2

Tools and Equipment:

a. Chipping tools
b. Vise
c. Machinery's Handbook

CLASSROOM HOURS 1

EVALUATION (MS-17)

Given an assigned chipping to be done, the student will be able to choose the correct type of chisel and use the chisel to chip the material to appropriate tolerances following all procedures and safety precautions.

TASK

MS-18 Using hand taps, dies and hand reamers

PERFORMANCE OBJECTIVE

Use hand taps, dies and hand reamers to size and ream holes and cut threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Threads
    1. National Fine (N.F.)
    2. National Coarse (N.C.)
b. Tapering pipe taps
c. Bottom taps
d. Tap sets
e. Plug taps
f. Blind hole
g. Pulley tap
h. Tap drill
i. Tap drill sizing formula
j. Tap safety

(Continued on back)

Provide Demonstration On:

a. Checking a tap for square alignment with a hole
b. Using a tap set
c. Cut threads using a die set

Provide Practical Application On:

a. Tap a hole with a handtap.
b. Cut threads with a hand die.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #505-5, "Bench Metal Work"
b. Prentice-Hall, Filmstrip #VD930-4, "Machine Shop: Bench Operations"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #18

Tools and Equipment:

a. Handtaps
b. Dies
c. Reamers
d. American Machinist's Handbook
e. Machinery's Handbook
f. Squares

CLASSROOM HOURS

3

EVALUATION (MS-18)

a. Given a tap set and a hand die set, the student will be able to tap threads in a hold and cut threads on a pipe following appropriate procedures and all safety precautions.

b. V-TECS, Machine Shop, Task No. 57, 59 and 64.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

k. Dies
    1. Threading dies
    2. Solid threading dies
    3. Adjustable die
    4. Die stock
l. Chamfering a rod prior to threading
m. Lubrication
n. Major diameter and minor diameter
o. Safety

TASK

MS-19 Identifying power tool safety practices

PERFORMANCE OBJECTIVE

Identify safety procedures for using power tools in bench work.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of power tools
    1. Electrical
    2. Pneumatic
b. Electrical hazards
c. Mechanical hazards
d. Safety rules for:
    1. Power drills
    2. Impact wrenches
    3. Power drivers
    4. Polishes

Provide Practical Application On:

List safety rules for operation of:

a. Power drills
b. Impact wrenches
c. Power drivers
d. Polishers

INSTRUCTIONAL MATERIALS

A/Vs:

Bergwall, filmstrip #514, "Working With Power Tools and Machines"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #19

Tools and Equipment:

a. Safety posters
b. U.S. Navy, Tools and Their Uses

CLASSROOM HOURS

½

EVALUATION (MS-19)

Given several power tools used in the machine shop, the student will be able to identify electrical and mechanical hazards associated with use of the tool and related safety practices.

TASK

MS-20 Assembling and fitting

PERFORMANCE OBJECTIVE

Make a drive, sliding, running and shrink fit for outside and inside measurements for gears, pulleys, bushings, shafts, spindles and threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Standard shafting
b. Tolerance
c. Precautions in making a press fit
d. Types/kinds of running fits
e. Shrink fit
f. Types of fits
    1. Loose fit
    2. Free fit
    3. Medium fit
    4. Snug fit
    5. Wringing fit
    6. Tight fit
    7. Medium fit
    8. Heavy force and shrink fit

Provide Demonstration On:

Making the following types of fits:
a. Drive
b. Sliding
c. Running
d. Shrink

Provide Practical Application On:

Make the following types of fits:
a. Drive
b. Sliding
c. Running
d. Shrink

INSTRUCTIONAL MATERIALS

Textbooks:

Burghardt, Part I

A/Vs:

Bergwall, Filmstrip #505-6, "Bench Metal Work"

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #20
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

Machinery's Handbook

CLASSROOM HOURS

2½

EVALUATION (MS-20)

Given necessary tools and equipment, the student will be able to make drive, sliding, running and shrink fits according to correct procedure, following all safety practices.

TASK

MS-21 Identifying fasteners

PERFORMANCE OBJECTIVE

Identify types of screws, bolts and nuts.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cut screw thread
b. Rolled screw thread
c. Screw thread inspection methods
d. Types of cuts on machine screws
e. Included angle of the standard V-thread
f. Purpose of an eye bolt
g. Allen set screws
h. Process of rolling a thread
i. Screw thread forms
j. Types of pins
k. Types of T-slot nuts
l. Types of washers
m. Types of screwheads
n. Types of screws
o. Studs

Provide Practical Application On:

Identify various fasteners from a random selection.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

A/Vs:

Prentice-Hall, filmstrip #XF1128-3, "Working with Nuts and Bolts"

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #21
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. American Machinist's Handbook
b. Commercial Supply Catalogs
c. Machinery's Handbook
d. Selection of fasteners

CLASSROOM HOURS

1

EVALUATION (MS-21)

Given a random selection of fasteners, the student will be able to correctly identify each fastener and describe its application.

TASK

MS-22 Using thread, center, fillet and radius gages

PERFORMANCE OBJECTIVE

Use the thread, center, fillet and radius gages for accurate gaging in bench work operations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tolerance or allowance on threads
b. Methods of measuring screw threads
c. Wire methods of gaging threads
d. Screw thread micrometer
e. Types of threads
f. Fillet gage
g. Radius gage

Provide Demonstration On:

a. Using a screw thread micrometer
b. Using a fillet gage
c. Using a radius gage
d. Choosing a gage

Provide Practical Application On:

Choose a gage for an assigned measurement and gage using either a thread, center, fillet or radius gage as appropriate.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, Filmstrip #503, "Measuring Tools Explained"

Student Manuals:

a. Ohio, Machine Trades I, Bench Work Assignment Sheet #22
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Thread gage
b. Fillet gage
c. Center gage
d. Radius gage

(Continued on back)

CLASSROOM HOURS 1

EVALUATION (MS-22)

Given an assigned measurement and appropriate gages, the student will choose the appropriate gage and make a measurement using either a thread, center, fillet or radius gage to the instructor's satisfaction.

INSTRUCTIONAL MATERIALS (continued)

Tools and Equipment:

e. American Machinist's Handbook
f. Machinery's Handbook

TASK

MS-23 Identifying lubricants and greases

PERFORMANCE OBJECTIVE

Identify lubricants and greases used for machine maintenance.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Grease
b. Greasing devices
c. Lubricants used for vertically mounted motor
d. Lubricants used for horizontal motors
e. Viscosity
f. Bearing overheated factors
g. Lubrication systems
h. Drip and wick feeds

Provide Demonstration On:

Choosing a lubricant for a given application

Provide Practical Application On:

Choose the appropriate lubricant for a given application.

INSTRUCTIONAL MATERIALS

Textbooks:

Machinery's Handbook

A/Vs:

Bergwall, Filmstrip #501,
"The Lathe Explained"

Student Manuals:

Ohio, *Machine Trades I*, Bench Work Assignment Sheet #23

Tools and Equipment:

Commercial supplier's catalogs

CLASSROOM HOURS

1

EVALUATION (MS-23)

Given specifications for a machine which requires lubrication and a lubricant supplier's catalog, the student will be able to choose the appropriate lubricant and method of lubrication to the instructor's satisfaction.

TASK

MS-24 Performing machine maintenance

PERFORMANCE OBJECTIVE

Perform general shop repairs to maintain shop equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Responsibility for repairs in shop
b. Troubleshooting procedures
c. Using manufacturer's service manual
d. Safety in machine maintenance

Provide Demonstration On:

Troubleshooting shop machinery

Provide Practical Application On:

Troubleshoot a machine which is down and diagnose the problem.

INSTRUCTIONAL MATERIALS

Textbooks:

Specific manufacturer's service manuals

A/Vs:

Prentice-Hall Media, Filmstrip #XF 928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #24

CLASSROOM HOURS 2

EVALUATION (MS-24)

Given a machine which requires service and a manufacturer's service manual, the student will be able to troubleshoot and diagnose the problem and identify the correct repair procedure to the instructor's satisfaction.

TASK

MS-25 Identifying bench work safety

PERFORMANCE OBJECTIVE

Identify hazards and safety precautions in working with hand tools and portable power tools in the machine shop.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Eye protection
b. Foot protection
c. Ear protection
d. Dust and hazardous fumes
e. Clothing, hair and jewelry
f. Hand protection
g. Lifting

Provide Demonstration On:

Identifying safety hazards in the shop

Provide Practical Application On:

Identify safety hazards in the shop and recommend solutions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Porter
c. Kibbe

A/Vs:

Bergwall, Filmstrip series #514, "Metal Shop Safety"

Student Manuals:

Ohio, Machine Trades I, Bench Work Assignment Sheet #25

Tools and Equipment:

Safety goggles

CLASSROOM HOURS 1

EVALUATION (MS-25)

Given safety hazards in the shop, the student will be able to identify the hazards and recommend safe solutions to the instructor's satisfaction.

TASK

MS-26 Identifying parts and functions of the drilling machine

PERFORMANCE OBJECTIVE

Identify the parts of a drilling machine and describe their operations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Parts of the upright drill press
b. Purpose of the parts
c. Functions of the drill press
d. Safety

Provide Demonstration On:

Operating a drill press

Provide Practical Application On:

Identify the parts of the drill press and explain what each part does

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Prentice-Hall, filmstrip #929-1, "Machine Shop: Drill Press"

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #1

Tools and Equipment:

Upright drill press

CLASSROOM HOURS

1

EVALUATION (MS-26)

Given an upright drill press, the student will accurately identify each part correctly and describe its function to the instructor's satisfaction.

TASK

MS-27 Identifying safety practices and precautions when using the drilling machine

PERFORMANCE OBJECTIVE

Identify safety practices and precaution on a drilling machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Using clamps
b. Broken bits
c. Turning workpiece due to "grabbing" drill bit
d. Keeping drill press table clean of tools
e. Lifting heavy pieces
f. Removing chuck key
g. Hand safety
h. Eye safety
i. Head safety

Provide Practical Application On:

Demonstrate safe drilling machine practice by choosing appropriate safety gear and demonstrate safe working practices.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Porter
c. Kibbe

A/Vs:

Prentice-Hall, filmstrip #929-1, "Machine Shop: Drill Press"

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment #2

Tools and Equipment:

a. Safety goggles or face shield
b. Safety hat

CLASSROOM HOURS 1

EVALUATION (MS-27)

Given a drilling machine and appropriate safety gear, the student will demonstrate correct safety precautions by choosing the appropriate safety gear and demonstrating safe operating practices to the instructor's satisfaction.

TASK

MS-28 Identifying work-holding devices and set ups

PERFORMANCE OBJECTIVE

Identify work holding and locating device used on drilling machines.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of work holding devices
b. Methods
    1. T-bolts and clamps
    2. Parallels
    3. C-clamps
    4. Angle plates
    5. Drill press vises
    6. Cold finished key stock
    7. Vee-blocks
c. Safety

Provide Demonstration On:

Using T-bolts and clamps to hold work down on the drill press

Provide Practical Application On:

a. Use T-bolts and clamps to hold work on the drill press.
b. Identify various types of drill press work holding devices.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Prentice-Hall, filmstrip #929-1, "Machine Shop: Drill Press"

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #3

Tools and Equipment:

a. T-bolts
b. Clamps
c. Parallels
d. C-clamps
e. Angle plates
f. Drill press vises
g. Vee-blocks

CLASSROOM HOURS

1

EVALUATION (MS-28)

Given a selection of drill press work holding devices, the student will accurately identify each device and will be able to locate and bolt down a workpiece on the press using T-bolts and clamps to the instructor's satisfaction.

TASK

MS-29 Identifying and using drill bit holding devices

PERFORMANCE OBJECTIVE

Identify and be able to use drill bit holding devices on the drilling machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Drill chuck
b. Shank
c. Tang on tapered shanks
d. Drift or key
e. Drill bit holding devices
f. Safety

Provide Information On:

Mounting a drill bit on the drilling machine

Provide Practical Application On:

Mount a drill bit on the drilling machine.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Prentice-Hall, filmstrip #929-2, "Machine Shop: Drill Press"

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #4

Tools and Equipment:

a. Drill bit
b. Drilling machine
c. Chuck

CLASSROOM HOURS

½

EVALUATION (MS-29)

a. Given a drilling machine, drill bit and chuck, the student will accurately follow procedures to mount a drill bit on the drilling machine observing all safety precautions to the instructor's satisfaction.

v. V-TECS, Machine Shop, Task No. 62.

TASK

MS-30 Identifying drill bits

PERFORMANCE OBJECTIVE

Identify types, sizes and nomenclatures of drill bits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. 4 parts of a twist drill bit
b. Types of shanks
c. Purpose of flutes
d. Sizes of twist drills
e. Checking a drill for correct size
f. Using an oil hole drill
g. Lip angle
h. Purpose of tang
i. RPM, FPM

Provide Demonstration On:

Checking a drill for correct size for a given job

Provide Practical Application On:

Check a drill for correct size for a given job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #5

Tools and Equipment:

a. Twist drill bits
b. Drill gage
c. Cleveland Twist Drill Company, Use and Care of the Twist and Drill

CLASSROOM HOURS

1

EVALUATION (MS-30)

Given specifications for a job, a drill gage and a selection of twist drill bits, the student will be able to select the correct size twist drill for the job to the instructor's satisfaction.

TASK

MS-31 Identifying cutting feeds and speeds

PERFORMANCE OBJECTIVE

Identify drill feeds and speeds.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of steel used for twist drills
b. Identifying the high speed drill
c. Setting the speed on a high speed drill 4 x cutting speed ÷ drill diameter
d. The feed of a drill
e. FPM
f. RPM

Provide Demonstration On:

a. Figuring the cutting speed of a given drill
b. Figuring speed

Provide Practical Application On:

a. Figure the cutting speed of a given drill.
b. Figure feed.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #6

Tools and Equipment:

a. Drill bits
b. Drilling machine
c. Assigned job
d. Cleveland Twist & Drill Company, Use and Care of the Twist Drill

CLASSROOM HOURS

1½

EVALUATION (MS-31)

a. Given all appropriate tools, supplies and equipment, the student will accurately calculate the feed (in FPM) and speed (in RPM) of a H. S. twist drill for a specific job to the instructor's satisfaction.

b. V-TECS, Machine Shop, Task No. 64.

TASK

MS-32 Identifying principles of straight drilling

PERFORMANCE OBJECTIVE

Identify principles and procedures of straight drilling on the drilling machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Drilling
b. Pilot of bad hole
c. Scribing a circle in the workpiece
d. Calculating and setting speed and feeds
e. Feeding by hand
f. Chipped tips
g. Drawing or pulling a hole
h. Drilling brass

Provide Demonstration On:

Using the drilling machine to perform straight drilling.

Provide Practical Application On:

Drill straight through an assigned workpiece.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #505-5, "Bench Metalwork"
b. Prentice-Hall Media, filmstrip #XF929, "Machine Shop: Drill Press"

Student Manuals:

Ohio, *Machine Trades I*, Drilling Machine Work Assignment Sheet #7

Tools and Equipment:

a. Drill press
b. Twist drill bits
c. Assigned workpiece

CLASSROOM HOURS 2

EVALUATION (MS-32)

a. Given an assigned workpiece, the student will accurately secure the piece on the drill press, select a drill bit, calculate feed and speed, and drill straight through the piece observing all safety precautions to the instructor's satisfaction.

b. V'TECS, Machine Shop, Task No. 56.

TASK

MS-33 Identifying and using coolants and cutting compounds

PERFORMANCE OBJECTIVE

Identify coolants used when drilling or reaming.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cutting oils
b. Cutting compounds
c. Advantages of using oils and compounds
d. Using terpentine
e. Oil tube drill
f. Reclaiming cutting oils
g. Selecting coolant formula
h. Using a cutting compound
i. Cutting compounds for cast iron
j. Cutting compounds for brass

Provide Demonstration On:

a. Selecting a coolant formula.
b. Using a cutting compound.

Provide Practical Application On:

a. Select a coolant formula for a given job.
b. Using a cutting compound.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #8

Tools and Equipment:

a. Machinery's Handbook
b. American Machinist's Handbook

CLASSROOM HOURS 1½

EVALUATION (MS-33)

Given a specified job, the student will accurately select the appropriate cutting lubricant or compound and drill the stock using the lubricant or compound according to appropriate safe procedure.

TASK

MS-34 Grinding and care of drills

PERFORMANCE OBJECTIVE

Identify and observe proper care and use of drills and be able to correctly grind a drill bit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Parts of a drill bit
b. Grinding the web of a drill bit (proper web size)
c. Lip angles
d. Lip clearance angle
e. Causes of over-size drilled holes
f. Other drill clearances
g. Measuring the drill bit size

Provide Demonstration On:

Grinding the web of a drill bit to proper web size

Provide Practical Application On:

Grind the web of a drill bit to proper web size.

INSTRUCTIONAL MATERIALS

Testbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #505-5, "Bench Metalwork"
b. Prentice-Hall Media, Filmstrip #XF929, "Machine Shop: Drill Press"

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #9

Tools and Equipment:

a. Drill bits
b. Emery wheel
c. Twist drill gage
d. Machinery's Handbook
e. Handbook for Drillers

CLASSROOM HOURS

1½

EVALUATION (MS-34)

a. Given a drill bit and an emery wheel, the student will accurately grind the web of the bit ot proper size and gage the size correctly to the instructor's satisfaction.

b. V'TECS, Machine Shop, Task No. 59.

TASK

MS-35 Identifying and using twist drill gages

PERFORMANCE OBJECTIVE

Identify and use gages used in drill grinding.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Twist drill gage
b. Drill point gage
c. Universal drill grinding gage
d. Reading the twist drill gage
e. Reading the drill point gage

Provide Demonstration On:

a. Using the twist drill gage
b. Using the drill point gage

Provide Practical Application On:

a. Use the twist drill gage & check a twist drill for size.
b. Use the drill point gage to check the angle of the point.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #505-5, "Bench Metalwork"
b. Prentice-Hall Media, filmstrip #XF919, "Machine Shop: Drill Press"

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #10

Tools and Equipment:

a. Twist drill gage
b. Drill point gage
c. Twist drill

CLASSROOM HOURS 1½

EVALUATION (MS-35)

Given a twist drill gage and a drill point gage, the student will accurately measure several drills for point angle and size to the instructor's satisfaction.

TASK

MS-36 Identifying and using drill grinding machines

PERFORMANCE OBJECTIVE

Identify and be able to use a drill grinding machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Drill grinding machines
   1. Types
   2. Applications
b. Hand grinding
c. Advantages of machine grinding
d. Adapting a regular pedestal grinder
e. Safety

Provide Demonstration On:

Using the drill grinder to correctly grind a drill.

Provide Practical Application On:

Grind a drill on the drill grinder to proper size and point angle.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #11

Tools and Equipment:

a. Drill grinding machine
b. Drill gage
c. Drill point gage
d. Twist drills
e. Safety glasses

CLASSROOM HOURS 1

EVALUATION (MS-36)

a. Given a drill grinding machine, drill gage, point gage and twist drill, the student will accurately grind the drill bit to proper size and point angle observing all safety precautions to the instructor's satisfaction.

b. V'TECS, Machine Shop, Task No. 59.

TASK

MS-37 Identifying machine reamers

PERFORMANCE OBJECTIVE

Identify sizes, types, nomenclature, specifications, selection and storage of machine reamers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of machine reamers
b. Purpose of a taper reamer
c. Expansion reamer
d. Shell reamer
e. Rose reamer (parts of)
f. Carbide tipped reamers
g. Spiral fluted reamer
h. Method of holding taper shank reamer
i. Method of holding straight shank reamer
j. Storage of reamers
k. Safety

Provide Demonstration On:

Selection of a reamer for a job

Provide Practical Application On:

Select a reamer for a specific job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #505-5, "Bench Metalwork"
b. Prentice-Hall Media, Filmstrip #XF929, "Machine Shop: Drill Press"

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #12

Tools and Equipment:

a. Various types of reamers
b. Cleveland Twist Drill Company, Use and Care of Reamers

CLASSROOM HOURS

2

EVALUATION (MS-37)

a. Given specifications for a job, the student will accurately select the best reamer for the job to the instructor's satisfaction.

b. V'TECS, Machine Shop, Task No. 58.

TASK

MS-38 Machine reaming

PERFORMANCE OBJECTIVE

Machine reaming with the drilling machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Figuring reaming feed and speed
b. Using cutting oils and compounds for reaming
c. Purpose of reaming
d. Classifying reamers
e. Hand reaming vs machine reaming
f. Reamer safety

Provide Demonstration On:

a. Calculating reaming feed and speed for a specific job
b. Reaming procedure

Provide Practical Application On:

a. Calculate feed and speed for a reaming job.
b. Use a reamer to ream four 7/8" holes.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #505-5, "Bench Metalwork"
b. Prentice-Hall Media, Filmstrip #XF929, "Machine Shop: Drill Press"

Student Manuals:

Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #13

Tools and Equipment:

a. Drilling machine
b. Reamers
c. Safety glasses
d. Machinery's Handbook

(continued on next page)

CLASSROOM HOURS 1

EVALUATION (MS-38)

a. Given a reaming job, the student will be able to select the appropriate reamer, calculate speed and feed, and accurately ream four 7/8 inch holes to the instructor's satisfaction.

b. V-TECS, Machine Shop, Task No. 58.

INSTRUCTIONAL MATERIALS (continued)

Tools and Equipment:

e. American Machinist's Handbook
f. Cleveland Twist Drill Company, Use and Care of Reamers

TASK

MS-39 Identifying principles of boring and counterboring

PERFORMANCE OBJECTIVE

Identify procedures for boring and counterboring, using a drilling machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Difference between boring and counterboring
b. Boring vs reaming
c. Procedure for producing a straight and accurate hole
d. Adjustable single-point boring tool
e. Types of counterbores
f. Parts of the counterbore
g. Purpose of the guide or pilot on the counterbore
h. Removable blade counterbore vs solid counterbore
i. Safety

Provide Demonstration On:

a. Procedure for producing a straight and accurate hole
b. Boring a hole
c. Counterboring a hole

Provide Practical Application On:

a. Bore a hole.
b. Counterbore a hole.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Prentice-Hall Media,
Filmstrip #XF929,
"Machine Shop:
Drill Press"

Student Manuals:

Ohio, Machine Trades I,
Drilling Machine Work
Assignment Sheet #14

Tools and Equipment:

a. Machinery's Handbook
b. American Machinist's Handbook
c. Drilling machine
d. Bore
e. Counterbore
f. Safety glasses

CLASSROOM HOURS

1½

EVALUATION (MS-39)

a. Given appropriate tools, supplies and equipment, the student will be able to bore and counterbore holes which are straight and accurate following all standard safety practices.

b. V-TECS, Machine Shop, Task No. 53.

TASK

MS-40 Spot facing

PERFORMANCE OBJECTIVE

Identify procedures and be able to use the drill press in spot facing operations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Spot facing (purpose)
b. Spot facing tool
c. Spot facing vs counterboring
d. Spot facing cast iron
e. Spot facing speeds/feeds
f. Safety

Provide Demonstration On:

Procedure for spot facing

Provide Practical Application On:

Spot face a piece of material which has been drilled according to given specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Prentice-Hall Media, filmstrip #XF929 "Machine Shop: Drill Press"

Student Manuals:

Ohio, *Machine Trades I*, Drilling Machine Work Assignment sheet #15

Tools and Equipment:

a. Drilling machine
b. Spot facing tool
c. Pre-drilled metal stock
d. Safety glasses

CLASSROOM HOURS ½

EVALUATION (MS-40)

a. Given a drilling machine and all necessary tools and supplies, the student will accurately spot face a pre-drilled piece of material to given specifications to the instructor's satisfaction.

b. V-TECS, Machine Shop, Task No. 65.

TASK

MS-41 Counter sinking and center drilling

PERFORMANCE OBJECTIVE

Perform counter sinking and center drilling operations on the drilling machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Counter boxing vs counter sinking
b. Purpose of counter sinking
c. Counter sinking angles
d. Causes of chattering (prevention)
e. Center drilling vs counter sinking
f. Angle of center drill
g. Safety

Provide Demonstration On:

a. Procedure for counter sinking
b. Procedure for center drilling

Provide Practical Application On:

a. Counter sink a workpiece.
b. Center drill a workpiece.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Prentice-Hall Media, filmstrip # XF929 "Machine Shop: Drill Press"

Student Manuals:

Ohio, *Machine Trades I*, Drilling Machine Work Assignment Sheet #16

Tools and Equipment:

a. *Machinery's Handbook*
b. Drilling machine
c. Counter sinking tool
d. Center drilling tool
e. Safety glasses

CLASSROOM HOURS 1

EVALUATION (MS-41)

a. Given all necessary tools and equipment, the student will be able to accurately counter sink a work piece (pre-drilled) to specifications following all safety practices.

b. Given all necessary tools and equipment, the student will be able to accurately center drill a work piece (pre-drilled) to specifications following all safety practices.

c. V-TECS, Machine Shop, Task No. 54.

TASK

MS-42 Identifying lathe safety

PERFORMANCE OBJECTIVE

Identify safe practices and precautions for engine lathe work.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Importance of safety
b. Hazards
    1. Long sleeves
    2. Rings, watches, etc.
    3. Files without handles
    4. Pinch points
    5. High temperature components
    6. Sharp edges
c. Safety practices
d. Personal protection gear
e. House keeping

Provide Demonstration On:

Proper filing technique in the lathe

Provide Practical Application On:

List six hazards in lathe operation and how to avoid them.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Porter
c. Kibbe

A/Vs:

Bergwall, Filmstrip # 514, "Metal Shop Safety"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #1

CLASSROOM HOURS 2

EVALUATION (MS-42)

Given an overview of lathe safety practices, the student will be able to list at least six safety hazards in lathe operation and the associated safety precautions to the instructor's satisfaction.

TASK

MS-43 Identifying lathes

PERFORMANCE OBJECTIVE

Identify engine lathe types and sizes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Brief history of automation in industry
b. The lathe
    1. Determining engine size
    2. Three basic types
    3. Purpose of various sizes
    4. Purpose of headstock
    5. Standard vs quick change geared
    6. "Live center" vs "dead center"
    7. Operations which can be performed on a lathe
    8. Gages and how they are used

Provide Practical Application On:

a. Identify and describe the purpose of the parts of a lathe on a diagram.
b. List the operations which can be performed on a lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #501-1, "The Lathe Explained"
b. Prentice-Hall Media, Filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #1

Tools and Equipment:

Diagram of a lathe

CLASSROOM HOURS

2

EVALUATION (MS-43)

Given a diagram of a lathe, the student will be able to identify each part or control and describe its use accurately and list at least five operations which can be performed on a lathe.

TASK

MS-44 Identifying work-holding devices

PERFORMANCE OBJECTIVE

Identify work-holding devices as used on a lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Lathe spindle nose
b. Chucks
c. Drive plates
d. Face plates
e. Collets
f. Centering accuracy of various chucks

Provide Practical Application On:

Identify several types of chucks in the lab.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #501-2, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #3

Tools and Equipment:

Several types of chucks

CLASSROOM HOURS

1½

EVALUATION (MS-44)

a. Given a selection of lathe work holding devices, the student will be able to identify each type of chuck and describe its relative accuracy to the instructor's satisfaction.

b. V-TECS, Machine Shop, Task No. 110.

TASK

MS-45 Identifying cutting tools

PERFORMANCE OBJECTIVE

Identify cutting tools and tool holding devices on the lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cutting tools
b. Geometric form of lathe tools
c. Tool grinding
d. Tool holder
e. Tool holder with back rake
f. Cutting angles
g. Chip safety (chip breakers)
h. Heat hazards

Provide Demonstration On:

a. Grinding a lathe tool
b. Choosing a tool

Provide Practical Application On:

Choose a tool for a specified job and grind the tool to proper shape and dimensions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #501-3, "The Lathe Explained"
b. Prentice-Hall Media, Filmstrip # XF 928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #4 and #5
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Grinding wheel
b. Lathe tools
c. South Bend Lathe Works, How to Run a Lathe

CLASSROOM HOURS 1½

EVALUATION (MS-45)

Given specifications for a lathe operation, the student will be able to correctly choose the appropriate tool for the job and follow correct procedure in grinding the tool to proper shape for use on the lathe to the instructor's satisfaction.

TASK

MS-46 Identifying measuring tools

PERFORMANCE OBJECTIVE

Identify measuring tools used in engine lathe work.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Calipers
b. Micrometer
c. Snap and plug gages
d. Steel rules
e. Depth gages
f. Safety

Provide Demonstration On:

Using the following to make measurements:
- a. Calipers
- b. Micrometer
- c. Snap and plug gages
- d. Steel gages
- e. Depth gages

Provide Practical Application On:

Use the following instruments to make assigned measurements:
- a. Calipers
- b. Micrometer
- c. Snap and plug gages
- d. Steel rules
- e. Depth gage

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Porter
c. Kibbe

A/Vs:

Bergwall, Filmstrip #503, "Measuring Tools"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #6
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Calipers (inside and outside)
b. Micrometer
c. Snap and plug gages
d. Steel rules

(continued on next page)

CLASSROOM HOURS 1

EVALUATION (MS-46)

Given assigned objects to measure, the student will be able to follow correct procedure and use the following tools to make measurements:
- a. Calipers
- b. Micrometer
- c. Snap and plug gages
- d. Steel ruler
- e. Depth gages

INSTRUCTIONAL MATERIALS

Tools and Equipment:

- e. Depth gage
- f. South Bend Lathe Works, How to Run a Lathe
- g. U. S. Navy, Tools and Their Uses

TASK

MS-47 Identifying lathe attachments

PERFORMANCE OBJECTIVE

Identify attachments used on an engine lathe and describe their uses.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Center rest
b. Turning long, slim work
c. Follower rest
d. Taper attachment

Provide Demonstration On:

Mounting the following on a lathe:
    a. Center rest
    b. Follower rest
    c. Taper attachment

Provide Practical Application On:

Identify various types of lathe attachments in the lab and mount the following on the lathe:
    a. Center rest
    b. Follower rest
    c. Taper attachment

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #501-3, "The Lathe Explained"
b. Prentice-Hall Media, Filmstrip # XF 928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work, Assignment Sheet #7

Tools and Equipment:

a. Center rest
b. Follower rest
c. Taper attachment
d. Lathe
e. Hand tools
f. South Bend Lathe Works, How to Run a Lathe

CLASSROOM HOURS

1

EVALUATION (MS-47)

Given appropriate tools, supplies and equipment, the student will be able to mount and describe the use of on the lathe the following attachments:

a. Center rest
b. Follower rest
c. Taper attachment

TASK

MS-48 Calculating cutting feeds and speeds on the lathe

PERFORMANCE OBJECTIVE

Calculate cutting feeds and speeds on the lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cutting speed formula
b. Feed
c. Cutting speed
d. Formula for circumference of a circle
e. Variance in cutting speed
f. Figuring feed

Provide Demonstration On:

a. Figuring cutting speed
b. Figuring feed

Provide Practical Application On:

Figure cutting speed and feed for a specified job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip # 501-2, "The Lathe Explained"
b. Prentice-Hall Media, Filmstrip # XF 928, "Machine Shop: Engine Lathe

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #8
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Cutting tool
c. Work piece
d. South Bend Lathe Works, How to Run a Lathe

CLASSROOM HOURS 3

EVALUATION (MS-48)

Given specifications for a job and all necessary tools, supplies, and equipment, the student will be able to calculate the necessary feed and speed required to complete the job.

TASK

MS-49 Determining RPM

PERFORMANCE OBJECTIVE

Calculate RPM for a known cutting speed, rim speed, or surface speed on an engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Formula for figuring RPM of a lathe
b. Calculating the formula given cutting speed, rim speed, or surface speed

Provide Demonstration On:

Calculating lathe RPM given cutting speed, rim speed, or surface speed

Provide Practical Application On:

Work lathe RPM problems.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Berwall, filmstrip #501-2, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip # XF 982, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, *Machine Trades I*, Engine Lathe Work Assignment Sheet #9
b. *Machine Shop Training Course*, Vol. I

Tools and Equipment:

South Bend Lathe Works, *How to Run a Lathe*

CLASSROOM HOURS

2

EVALUATION (MS-49)

a. Given a known cutting speed, rim speed or surface speed, the student will be able to accurately calculate lathe RPM to the instructor's satisfaction.

b. V-TECS, Machine Shop, Task No. 109

TASK

MS-50 Centering stock

PERFORMANCE OBJECTIVE

Identify principles of centering stock on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Reason for various sizes of combination center drills
b. Methods of locating center holes
c. Standard angle for center holes
d. Square-facing the work
e. Testing the work for trueness
f. Finding centers of irregularly shaped work

Provide Demonstration On:

a. Centering a piece of work on a lathe
b. Testing for trueness

Provide Practical Application On:

Square and center a piece of work of a lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #501-2, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip XF 928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #10
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Workpiece
c. Test bar and dial indicators

(Continued on back)

CLASSROOM HOURS 2

EVALUATION (MS-50)

a. Given a specified job and all necessary tools and equipment, the student will be able to center the stock correctly on the engine lathe and check for accuracy of alignment.

b. V-TECS, Machine Shop, Task No. 85 and 86

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Centering tools
e. South Bend Lathe Works, How to Run a Lathe

TASK

MS-51 Identifying principles of facing

PERFORMANCE OBJECTIVE

Identify principles of and facing on an engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Facing
b. Leaving work longer than finished size
c. Right-cut facing tool
d. Half-center
e. Measuring
   1. Steel rule
   2. Vernier caliper
   3. Large micrometer

Provide Demonstration On:

Facing a workpiece

Provide Practical Application On:

Face a workpiece to specified dimensions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #501-4, "The Lathe Explained"
b. Prentice-Hall Media, Filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #11
b. Machine Shop Training Course, Vol. 1

Tools and Equipment:

a. Lathe
b. Cutting tool
c. Workpiece
d. Steel rules
e. South Bend Lathe Works, How to Run a Lathe

CLASSROOM HOURS

1½

EVALUATION (MS-51)

a. Given all necessary tools, equipment and specifications, the student will be able to face a workpiece to specifications, observing all safety practices to the instructor's satisfaction.

b. V-TECS, Machine Shop, Task No. 98.

TASK

MS-52 Identifying principles of straight turning and turning to shoulders

PERFORMANCE OBJECTIVE

Identify principles of straight turning and turning to shoulders.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Rough turning
    1. Tolerance
    2. Setting the compound
    3. Tool-holder
    4. Safety
    5. Making a trial cut to true up the piece
    6. Lubricating the tail center
b. Finish turning
    1. Selection of cutting
    2. Using the micrometer
    3. Safety

(Continued on back)

Provide Demonstration On:

a. Rough turning a piece
b. Finish turning
c. Turning a shoulder

Provide Practical Application On:

a. Perform straight turning on a piece.
b. Perform shoulder turning on a piece.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #501-4, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #12
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Cutting tools
c. Safety goggles
d. Micrometer
e. Fillet or radius gage

CLASSROOM HOURS 3

EVALUATION (MS-52)

a. Given appropriate tools, supplies and materials, the student will be able to perform turning operations on the lathe including straight turning and turning to shoulder to the instructor's satisfaction.

b. V-TECS, Machine Shop, Task No. 100.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. Turning to shoulder
    1. Machining a piece to several different diameters
    2. Square shoulder
    3. Angular shoulder
    4. Filleted shoulder
    5. Undercut shoulder
    6. Using the fillet or radius gage

TASK

MS-53 Identifying chucks

PERFORMANCE OBJECTIVE

Identify types, sizes, nomenclature, specifications, selection and storage of chucks.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of a chuck
b. Common types of chucks
    1. 3-jaw universal
    2. 4-jaw independent
    3. Jacobs chuck
    4. Draw-in collet chuck
c. Selecting chuck jaws
d. Mounting and removing chucks
e. Safety
f. Storage of chucks

Provide Demonstration On:

a. Selecting chuck jaws and installing them
b. Mounting and removing chucks

Provide Practical Application On:

Select chuck jaws and install them and correctly mount and remove chucks from a lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #501-4, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip # XF 928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #13
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Handtools
c. Chucks and jaws
d. Wooden board

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CLASSROOM HOURS 1½

EVALUATION (MS-53)

Given a specified job, the student will be able to select a chuck, mount the jaws, and be able to correctly mount and remove the chuck on the lathe observing all safety precautions.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

e. South Bend Lathe Works,
   How to Run a Lathe

TASK

MS-54 Form turning

PERFORMANCE OBJECTIVE

Perform the operation of form turning on the lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Free-hand form turning
b. Eye-hand coordination
c. Form turning with a tool ground to the desired shape
d. Operating controls for form turning
e. Tape operated machines
f. Spring tool
g. Setting the cutting speed

Provide Demonstration On:

Form turning on a lathe

Provide Practical Application On:

Form turn a specified shape on a lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

A/Vs:

a. Bergwall, filmstrip #501, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #14
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Workpiece
c. Hand tools
d. Cutting tools

CLASSROOM HOURS 2

EVALUATION (MS-54)

Given appropriate tools, supplies, equipment and specifications, the student will be able to form turn a workpiece to a specified shape to the instructor's satisfaction.

TASK

MS-55 Identifying face plate work

PERFORMANCE OBJECTIVE

Identify principles of face plate work and accessories used.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Accessories used for faceplate work
    1. End measuring rod
    2. Square head bolt
    3. Face-plate stud
    4. U-clamp
    5. Parallel
    6. Parallel strip
    7. Angle plate
    8. Stop block
b. Classes of work which are machined on a face plate
c. Trueing-up work on a face plate
d. Counterbalancing
e. Clamping the work

Provide Demonstration On:

Mounting a workpiece on a face plate using T-bolts and strap clamps

Provide Practical Application On:

Mount a workpiece on a face plate using T-bolts and strap clamps.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Brughardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #501-4, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip # XF 928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #16
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe with face plate
b. T-bolts
c. Strap clamps

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CLASSROOM HOURS

3½

EVALUATION (MS-55)

a. Given all necessary tools, supplies and equipment, the student will be able to mount a workpiece on a faceplate using T-bolts and strap clamps so that the work is held straight and true.

b. V-TECS, Machine Shop, Task No. 98.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Wrenches
e. South Bend Lathe Works,
How to Run a Lathe

TASK

MS-56 Using draw-in collets

PERFORMANCE OBJECTIVE

Identify principles of and be able to use draw-in collets on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Advantages of draw-in collets
b. How collets are held in a lathe
c. Classes of work held in collets
d. Advantages of hollow draw bar
e. Securing the collet in the collet sleeve
f. Collet safety

Provide Demonstration On:

Installing collets on the lathe

Provide Practical Application On:

Install a collet on a lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Berwall, filmstrip #501-3, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip # XF 928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #17
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Collet chuck
c. Wrenches

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CLASSROOM HOURS

2

EVALUATION (MS-56)

Given appropriate tools and equipment, the student will be able to install a collet chuck on a lathe following correct procedure and all safety precautions.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. South Bend Lathe Works,
How to Run a Lathe

TASK

MS-57 Identifying principles of drilling

PERFORMANCE OBJECTIVE

Identify and apply principles of drilling on an engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Mounting work for drilling
b. Pilot drilling
c. Lathe dog
d. Alignment
e. Necessity for reaming
f. Safety

Provide Demonstration On:

a. Mounting a straight shank drill in a drill chuck
b. Mounting workpiece
c. Drilling a workpiece

Provide Practical Application On:

Mount a drill in a chuck, mount assigned work and drill to given specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, filmstrip #505-5, "Bench Metalwork"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #18
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Drill
c. Drill chuck

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CLASSROOM HOURS

1

EVALUATION (MS-57)

a. Given all necessary tools, equipment and specifications, the student will be able to drill a workpiece to specified dimensions following all standard safety practices.

b. V-TECS, Machine Shop, Task No. 97.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Collet or face plate
e. Tools
f. Lathe dog (for larger drills)
g. Safety goggles
h. South Bend Lathe Works, *How to Run a Lathe*

TASK

MS-58 Identifying machine reamers

PERFORMANCE OBJECTIVE

Identify reamers used on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of reamers
b. Adjustable reamer
c. Shell reamer
d. Flutes of the reamer
e. Advantages of spiral flutes
f. Chucking reamer
g. Parts of a reamer

Provide Demonstration On:

a. Identifying parts of a reamer
b. Identifying types of reamers

Provide Practical Application On:

a. Identify the parts of a reamer (six).
b. Identify types of reamers.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Vol. I
b. Kibbe
c. Porter

A/Vs:

Bergwall, Filmstrip #505-5
"Bench Metalwork"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #19
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Reamer
b. Cleveland Twist Drill Company, Use and Care of Reamers

CLASSROOM HOURS

1

EVALUATION (MS-58)

Given a selection of reamers, the student will be able to correctly identify the type of reamer and correctly name the six basic parts of a reamer.

TASK

MS-59 Reaming on the engine lathe

PERFORMANCE OBJECTIVE

Perform reaming operations on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of reaming
b. How a reamer is held on the lathe
c. Calculating speeds and feeds for reaming
d. Lubricants for reaming
e. Small machine reamers
f. Alignment
g. Safety

Provide Demonstration On:

a. Mounting a reamer on the lathe
b. Reaming on the lathe

Provide Practical Application On:

Mount a reamer on a lathe and ream a hole in a pre-drilled workpiece to specified dimensions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, Filmstrip #505-5, "Bench Metalwork"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #20
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Reamers
b. Lathe
c. Workpiece
d. Tools

(continued on next page)

CLASSROOM HOURS

1

EVALUATION (MS-59)

a. Given a lathe, reamers, pre-drilled workpiece and specifications, the student will mount a reamer on the lathe and correctly ream the drilled holes on the workpiece to specified dimensions following all safety precautions.

b. V-TECS, Machine Shop, Task No. 104.

INSTRUCTIONAL MATERIALS (continued)

Tools and Equipment:

e. Safety goggles
f. Cleveland Twist Drill Company, Use and Care of Reamers

TASK

MS-60 Boring on the engine lathe

PERFORMANCE OBJECTIVE

Perform boring operations on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Boring
b. Methods of boring
c. Why a drilled hole must be bored
d. Forged boring tool
e. Boring bar holder
f. Measuring tools
g. Chatter and vibration
h. Through-boring
i. Thread-relief
j. Safety

Provide Demonstration On:

Boring a drilled hole

Provide Practical Application

Bore a drilled hole to specified dimensions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #505-5, "Bench Metalwork"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #21
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Drilled workpiece
c. Measuring tools
d. Boring tools
e. Safety goggles

CLASSROOM HOURS

3½

EVALUATION (MS-60)

a. Given appropriate tools, supplies and equipment, the student will be able to bore a drilled hole to specified dimensions, observing all safety precautions.

b. V-TECS, Machine Shop, Task No. 87.

TASK

MS-61 Identifying and using mandrels

PERFORMANCE OBJECTIVE

Identify types of and be able to use mandrels on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Mandrels (or lathe arbors)
b. Purpose of mandrels
c. Tapered mandrels
d. Lathe dog and set screw
e. Lubrication
f. Expanding mandrels
g. Gang mandrels
h. Stub mandrels
    1. Expanding stub mandrels
    2. Threaded stub mandrels
i. Safety

Provide Demonstration On:

Pressing a mandrel into a workpiece

Provide Practical Application On:

a. Press a mandrel into a workpiece.
b. Identify types of mandrels in the lab.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #505-5, "Bench Metalwork"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #22
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Workpiece
b. Mandrel(s)
c. Tools
d. Safety goggles

CLASSROOM HOURS

2½

EVALUATION (MS-61)

Given appropriate tools, supplies and equipment, the student will be able to select and press a mandrel into a workpiece following correct procedure and all safety precautions.

TASK

MS-62 Knurling on the engine lathe

PERFORMANCE OBJECTIVE

Identify types of tools and be able to perform knurling operations on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Knurling
b. Knurling patterns
  1. Diamond
  2. Straight
c. Knurling tool holders
  1. Knuckle-joint holder
  2. Revolving head holder
  3. Straddle holder
d. Holding the work
e. Lubrication
f. Cleaning knurls
g. Knurl cutting tool
h. Safety

Provide Demonstration On:

Making diamond pattern knurls on a rough piece of work

Provide Practical Application On:

Mount work on a lathe, mount on knurling tool, and make a diamond pattern knurl on the work to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, *Machine Trades I*, Engine Lathe Work Assignment Sheet #23
b. *Machine Shop Training Course*, Vol. I

Tools and Equipment

a. Engine Lathe
b. Knurling tool
c. Lubricant
d. Measuring tools
e. Safety goggles

CLASSROOM HOURS

1½

EVALUATION (MS-62)

a. Given all necessary tools, supplies and equipment, the student will be able to make diamond pattern knurls on a round workpiece to give specifications following all necessary safety precautions.

b. V-TECS, Machine Shop, Task No. 107.

TASK

MS-63 Cutting off on the engine lathe

PERFORMANCE OBJECTIVE

Perform cutting off operations on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Recessing, grooving, and parting
b. Types of tools
c. Squaring cut off tools with the work
d. Housekeeping
e. Lubrication
f. Step-parting
g. Chatter
h. Speeds
i. Safety

Provide Demonstration On:

Cutting a groove

Provide Practical Application On:

Cut a groove on a rough workpiece to given specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, filmstrip #505-2, "Bench Metalwork"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Assignment Sheet #24
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Engine lathe
b. Cutoff tools
c. Lubricant
d. Safety goggles

CLASSROOM HOURS 1½

EVALUATION (MS-63)

Given all necessary tools, supplies and equipment, the student will be able to cut a groove to specified dimensions on the engine lathe following all safety precautions.

TASK

MS-64 Identifying thread cutting devices

PERFORMANCE OBJECTIVE

Identify thread cutting devices on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Procedure for threading on a lathe
b. Setting up the lathe for threading
    1. Setting dials on the compound and cross-feed
    2. Setting apron controls
c. Spindle speeds
d. Cutting the thread
e. Left-hand threads
f. Multiple point tool
g. Picking up a thread

Provide Demonstration On:

a, Setting the lathe for cutting threads
b. Cutting threads

Provide Practical Application On:

Set up the lathe for cutting a specified thread and cut the thread.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #501-6, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #25
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Thread cutting tool
c. Safety goggles

CLASSROOM HOURS

2½

EVALUATION (MS-64)

Given all necessary tools and equipment, the student will be able to set up and operate the lathe to cut a specified thread to correct dimensions following all safety rules.

TASK

MS-65 Identifying the parts of a thread

PERFORMANCE OBJECTIVE

Identify the parts of a thread.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Major diameter of a screw
b. Pitch
c. Root and crest
d. Pitch diameter
e. Thread identification
f. Thread depth
g. Sharp-Vee thread form
h. Unified and American National Forms
i. Metric Threads Forms
j. Tolerance Symbols

Provide Demonstration On:

Identifying thread designations

Provide Practical Application On:

a. Show the pitch diameter of a screw.
b. Show the depth of a thread on a drawing.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #26
b. Machine Shop Training Course, Vol. I

CLASSROOM HOURS

1½

EVALUATION (MS-65)

Given a drawing of a screw, the student will be able to correctly identify the following dimensions on the screw to the instructor's satisfaction.

a. Major diameter
b. Pitch
c. Root and crest
d. Pitch diameter
e. Helix angle
f. Thread depth

TASK

MS-66 Identifying American National thread standards

PERFORMANCE OBJECTIVE

Identify American National thread standards.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Brief history of National Screw Thread Commission
b. Advantages of American National thread form
c. Included angle
d. National form thread series
e. Symbols used in specifying American threads standards
f. Coarse and fine threads

Provide Demonstration On:

Designating American National threads

Provide Practical Application On:

Designate American National threads given basic dimensions.

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #27
b. Machine Shop Training Course, Vol. I

CLASSROOM HOURS 1½

EVALUATION (MS-66)

Given basic dimensions, the student will be able to specify correctly American National Thread form designation for the thread to the instructor's satisfaction.

TASK

MS-67 Computing American National thread form

PERFORMANCE OBJECTIVE

Compute formulas for American National thread forms.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. American National thread forms
b. Formulas for:
    1. Pitch
    2. Diameter
    3. Major diameter
    4. Minor or root diameter
    5. Root and crest
    6. Single depth
    7. Double depth

Provide Demonstration On:

Computing formulas for:
    a. Pitch
    b. Diameter
    c. Major diameter
    d. Minor or root diameter
    e. Root and crest flats
    f. Single depth
    g. Double depth

Provide Practical Application On:

Compute formulas for:
    a. Pitch
    b. Diameter
    c. Major diameter
    d. Minor or root diameter
    e. Root and crest flats
    f. Single depth
    g. Double depth

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #28
b. Machine Shop Training Course, Vol. I

CLASSROOM HOURS 2½

EVALUATION (MS-67)

Given basic dimensions for American National Form threads, the student will be able to correctly compute the following:

- a. Pitch
- b. Pitch diameter
- c. Major diameter
- d. Minor or root diameter
- e. Root and crest flats
- f. Single depth
- g. Double depth

TASK

MS-68 Computing sharp V-thread formulas

PERFORMANCE OBJECTIVE

Compute sharp V-thread formulas from an example.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sharp V-thread
b. Dimensions
    1. Thread angle
    2. Pitch
    3. Depth
    4. Major diameter
    5. Pitch diameter
    6. Minor diameter
    7. Crest
    8. Side
    9. Root
c. Formulas
    1. Thread angle
    2. Pitch
    3. Depth
    4. Minor diameter
    5. Pitch diameter
    6. Major diameter

Provide Demonstration On:

Measuring and computing
    a. Thread angle
    b. Pitch
    c. Depth
    d. Minor diameter
    e. Pitch diameter
    f. Major diameter

Provide Practical Application On:

Measure and compute:
    a. Thread angle
    b. Pitch
    c. Depth
    d. Minor diameter
    e. Pitch diameter
    f. Major diameter

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #29
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Sharp V-thread screws
b. Measuring tools

CLASSROOM HOURS 3

EVALUATION (MS-68)

Given a screw which has sharp V-thread dimensions and appropriate measuring tools, the student will be able to compute the following dimensions accurately:

a. Thread angle
b. Pitch
c. Depth
d. Minor diameter
e. Pitch diameter
f. Major diameter

TASK

MS-69 Identifying acme threads

PERFORMANCE OBJECTIVE

Identify acme threads and compute dimensions.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Acme thread
b. Advantages of acme thread form
c. Applications of acme thread
d. Depth vs pitch
e. Classes
    1. 2G
    2. 3G
    3. 4G
f. Included angle
g. Formulas for pitch, depth and width

Provide Demonstration On:

a. Measuring an acme threaded screw with a wire gauge
b. Figuring pitch, depth and width of an acme thread

Provide Practical Application On:

a. Measure an acme thread with a wire thread gauge.
b. Figure pitch, depth and width of an acme thread.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #30
b. Machine Shop Training Course, Vol. 1

Tools and Equipment:

Wire thread gauge

CLASSROOM HOURS 3

EVALUATION (MS-69)

Given a screw or bolt with an acme thread form and appropriate gauges, the student will be able to accurately measure the screw or bolt and identify the pitch, depth and width of the threads to the instructor's satisfaction.

TASK

MS-70 Using the acme tap

PERFORMANCE OBJECTIVE

Identify acme tap drill sizes and use the acme tap.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Figuring the outside diameter of an acme internal
b. Setting the compound
c. Using an acme screw plug gauge
d. Purpose of an acme tap
e. Tap sets
f. Tapping steel (an oil)
g. Tapping bronze (no lubricant)

Provide Demonstration On:

Using the acme tap to cut
  a. Steel
  b. Bronze

Provide Practical Application On:

Use the acme tap to cut an internal thread to specifications in
  a. Steel
  b. Bronze

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Bergwall, filmstrip #505-5, "Bench Metalwork"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #31

Tools and Equipment:

a. Acme tap set
b. Lubricating oil

CLASSROOM HOURS 2½

EVALUATION (MS-70)

Given an acme tap set, bronze and steel work stock, lubricating oil, necessary tools and specifications, the student will be able to tap acme internal threads as specified in steel and bronze material, using lubrication when required.

TASK

MS-71 Identifying square threads

PERFORMANCE OBJECTIVE

Identify and figure dimensions of square threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Square threads
   1. Purpose
   2. Applications
b. Depth vs pitch
c. Flank clearance
d. Clearance on major diameter
e. Figuring thickness
f. Figuring pitch, width and depth

Provide Demonstration On:

Figuring the follwing dimensions on square thread
   a. Pitch
   b. Width
   c. Depth

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt
b. Kibbe
c. Porter

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #32
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Bolt with square thread
b. Measuring tools

CLASSROOM HOURS

3

EVALUATION (MS-71)

Given a square threaded bolt and appropriate measuring tools, the student will be able to correctly figure the pitch, width and depth of the square thread.

TASK

MS-72 Identifying classes of fits of screw threads

PERFORMANCE OBJECTIVE

Identify the classes of fits of screw threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. General thread fitting requirements
b. Unified National Course (UNC)
c. Unified National Fine (UNF)
d. Unified National Special (UNS)
e. Classes
    1. 1A, 2A, 3A
    2. 1B, 2B, 3B
f. Identifying screw thread designations

Provide Demonstration On:

Identifying screw thread designations

Provide Practical Application On:

Select a specified screw thread bolt, identify the classification correctly and identify applications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

Student Manuals:

Ohio, *Machine Trades I*, Engine Lathe Assignment Sheet #33

Tools and Equipment:

Selection of various sizes of threaded bolts

CLASSROOM HOURS

2

EVALUATION (MS-72)

Given specifications and a selection of threaded bolts, the student will be able to correctly identify the screw thread classification and identify general application of the type of screw thread to the instructor's satisfaction.

TASK

MS-73 Using thread gauges

PERFORMANCE OBJECTIVE

Use thread pitch gauges, center gauges, and plug and ring gauges.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Thread pitch gauge
    1. Applications
    2. Reading
b. Center gauges
    1. Procedure for use
    2. Applications
c. Plug and ring thread gauges
    1. Applications
    2. Procedures for use

Provide Demonstration On:

Using the following gauges to gauge threads:
    a. Thread pitch gauge
    b. Center gauges
    c. Plug and ring gauges

Provide Practical Application On:

Use the following gauges to gauge assigned threaded bolts:
    a. Thread pitch gauges
    b. Center gauge
    c. Plug and ring gauges

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #501-6, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #34

Tools and Equipment:

a. Thread pitch gauge
b. Center gauges
c. Plug and ring thread gauge
d. Threaded bolts

CLASSROOM HOURS 2½

EVALUATION (MS-73)

Given a series of assigned threaded bolts, the student will be able to use the following gauges to accurately measure screw threads:

1. Pitch
2. Center gauge
3. Plug and ring thread gauge

TASK

MS-74 Using a thread micrometer

PERFORMANCE OBJECTIVE

Use a thread micrometer to measure sharp V and American National threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Thread micrometer
   1. Purpose
   2. Parts
   3. Accuracy
b. Thread comparator
   1. Description
   2. Purpose
c. Using the thread micrometer
   1. Points of measurement
   2. Reading the scales

Provide Demonstration On:

Using a thread micrometer

Provide Practical Application On:

Use a thread micrometer to measure assigned threads.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Porter
c. Kibbe

A/Vs:

a. Bergwall, filmstrip #501-6, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, *Machine Trades I*, Engine Lathe Work Assignment Sheet #35
b. *Machine Shop Training Course*, Vol. I

Tools and Equipment:

a. Thread micrometer
b. Threaded bolts

CLASSROOM HOURS

2½

EVALUATION (MS-74)

Given a thread micrometer, the student will be able to accurately measure assigned sizes of threads to the instructor's satisfaction.

TASK

MS-75 Measuring threads with the three-wire method

PERFORMANCE OBJECTIVE

Measure threads using the three-wire method.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The three-wire method
b. "Best wire size"
c. Formula for pitch diameter
d. Three-wire gauging sets
e. Formula for best wire size

Provide Demonstration On:

a. Figuring best wire size
b. Figuring pitch diameter with the three wire method

Provide Practical Application On:

Use the three-wire method to figure pitch diameter of threads.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #501-6, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #36
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Three-wire gauge set
b. Threaded bolts

CLASSROOM HOURS

2

EVALUATION (MS-75)

Given a three-wire gauge set and an assigned set of bolts or other threaded items, the student will be able to use the three-wire method to accurately gauge the threads to the instructor's specification.

TASK

MS-76 Cutting threads with an even geared lathe

PERFORMANCE OBJECTIVE

Make all conputations and cut threads on an even geared lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Even geared lathes (change gear type)
b. Calculating change gears on an even geared lathe
c. Determining number of threads on lead screws
d. Cutting threads on the even geared lathe
e. Changing gears

Provide Demonstration On:

a. Calculating change gears on an even geared lathe
b. Changing gears
c. Cutting threads

Provide Practical Application On:

Make all necessary calculations and settings for cutting threads on an even geared lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

A/Vs:

a. Bergwall, filmstrip #501-6, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #37
b. Machine Shop Training Course, Vol. I
c. Georgia: Metals Fabrication Mathematics

Tools and Equipment:

a. Lathe
b. Round stock to be threaded

CLASSROOM HOURS

4

EVALUATION (MS-76)

Given all necessary tools, supplies and equipment, the student will be able to make all necessary calculations and settings to cut threads on an even geared lathe to given specifications.

TASK

MS-77 Cutting threads on a lathe which is not even geared

PERFORMANCE OBJECTIVE

Compute all formulas for thread cutting with change gears on a lathe which is not even geared.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Formula for figuring change gears on lathe which is not even geared
b. Even-geared lathes
c. Lead numbers
d. Change gears
e. Idle gears
f. Tumbler gears
g. Compound gears

Provide Demonstration On:

a. Figuring gears required to cut a thread
b. Changing out gears
c. Cutting threads

Provide Practical Application On:

Compute formulas for and set up an uneven geared lathe to cut threads to specified dim.

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

A/Vs:

a. Bergwall, filmstrip #501-6, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #38
b. Georgia, Metals Fabrication Mathematics

Tools and Equipment:

a. Uneven geared lathe
b. Gears
c. Wrenches
d. Threading tool
e. Workstock
f. Safety goggles

CLASSROOM HOURS

4

EVALUATION (MS-77)

Given all necessary tools, supplies and equipment, the student will be able to compute all formulas and set up an uneven geared lathe to cut threads to specified dimensions.

TASK

MS-78 Cutting threads on a quick-change gear lathe

PERFORMANCE OBJECTIVE

Cut threads on a quick-change gear lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Thread and feed plate
  1. Description and purpose
  2. Location
b. Quick-change gear
  1. Purpose
  2. Advantage
c. Procedure for setting up quick-change gear lathe
d. Formulas for thread cutting with quick-change gear lathe
e. Double lead screw

Provide Demonstration On:

Setting up the quick-change gear lathe to cut threads

Provide Practical Application On:

Set up and cut threads on a quick change gear lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

A/Vs:

a. Bergwall, filmstrip #501-6, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #40
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

Quick change gear lathe

CLASSROOM HOURS 3

EVALUATION (MS-78)

Given a quick-change gear lathe and all necessary tools, supplies and equipment, the student will correctly set up the lathe and cut threads on an assigned workpiece to specified dimension.

TASK

MS-79 Identifying multiple lead screw threads

PERFORMANCE OBJECTIVE

Identify multiple lead screw threads.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Multiple lead screw threads
   1. Description
   2. Purpose
   3. Lead
   4. Pitch
b. Applications of:
   1. Single lead screws
   2. Double lead screws
   3. Triple lead screws
   4. Multiple lead screws

Provide Practical Application On:

Identify parts and dimensions of multiple lead screws.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #501-6, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #41

Tools and Equipment:

a. Examples of multiple lead screws
b. Measuring tools

CLASSROOM HOURS

3½

EVALUATION (MS-79)

Given several multiple lead screws, the student will be able to identify the parts of the screw and measure the dimensions accurately to the instructor's satisfaction.

TASK

MS-80 Cutting left hand threads

PERFORMANCE OBJECTIVE

Cut left hand threads on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Lathe set-up for left hand threads
b. Symbols used for left hand threads
c. Necking a shaft
d. Left hand dies and taps

Provide Demonstration On:

Cutting left hand threads using:
  a. Threading tool
  b. Dies
  c. Taps

Provide Practical Application On:

Cut left hand threads on the lathe using:
  a. Threading tool
  b. Dies
  c. Taps

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #501-6, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #42

Tools and Equipment:

a. Lathe and tools to cut left hand threads
b. Left hand dies and taps

CLASSROOM HOURS

3½

EVALUATION (MS-80)

Given an engine lathe and all appropriate tools, supplies and materials, the student will be able to cut left hand threads to specified dimensions.

TASK

MS-81 Determining a tap drill size

PERFORMANCE OBJECTIVE

Determine a tap drill size for tap drilling on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tap drills
    1. Description
    2. Use
b. Formula for tap drill size of American Standard Screw Thread
c. 75% rule
d. Problems of tapping
e. Using a tap drill when exact size is not available
f. Safety

Provide Demonstration On:

Computing tap drill size for a specified job.

Provide Practical Application On:

Compute tap drill size for a specified job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall filmstrip #501-6, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #43
b. Machine Shop Training Course, Vol. II

CLASSROOM HOURS

1½

EVALUATION (MS-81)

Given specifications for a tapping operation, the student will be able to select the appropriate size tap drill for the job to the instructor's satisfaction.

TASK

MS-82 Cutting internal threads and tapping

PERFORMANCE OBJECTIVE

Cut internal threads and perform tapping operation on a lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of steel used to make taps
b. Cutting internal threads on a lathe
    1. Setting the compound
    2. Lubricants used
c. Using the center gauge
d. Blind holes (gauging)
e. Truing up the work
f. Chatter
g. Using the graduated collar for internal threading
h. Safety

Provide Demonstration On:

a. Cutting internal threads on an engine lathe
b. Tapping on an engine lathe

Provide Practical Application On:

Perform internal thread cutting and tapping operations on the engine lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #501-6, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #44

Tools and Equipment:

a. Engine Lathe
b. Bored workpiece
c. Depth gauge
d. Center gauge
e. Thread cutting tools
f. Tapping set
g. Safety goggles

CLASSROOM HOURS 5½

EVALUATION (MS-82)

a. Given all necessary tools, supplies and equipment, the student will be able to cut internal threads to specified dimensions and correctly perform tapping of the internal threads to the instructor's satisfaction.

b. V-TECS, Machine Shop, Task, No. 92.

TASK

MS-83 Identifying principles of taper turning

PERFORMANCE OBJECTIVE

Identify basic principles of taper turning and common tapers on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of tapers
b. Taper series
    1. Brown
    2. Sharpe
    3. Morse
c. Taper sizes
d. Tapering methods
    1. Compound slide method
    2. Offset tailstock method
    3. Taper attachment method
e. Procedure for setting up the taper attachment
f. Measurement tapers

Provide Demonstration On:

a. Figuring amount of taper in taper per foot (TPF)
b. Setting up the taper attachment
c. Measuring tapers

Provide Practical Application On:

Figure the amount of taper for a specified job (in TPF), set up the taper attachment and be able to measure tapers.

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

A/Vs:

a. Bergwall, filmstrip #505-5, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Assignment Sheet #45
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Engine lathe
b. Taper attachment
c. Inside and outside taper micrometers
d. Sine bar and gage blocks
e. Ring gage

CLASSROOM HOURS	5

EVALUATION (MS-83)

a. Given appropriate tools, supplies and equipment, the student will be able to calculate a specified taper in (TPF), correct by set up the taper attachment on the engine lathe for a specified taper, and be able to use assigned measuring instruments to measure given tapers accurately.

b. V-TECS, Machine Shop, Task No. 90.

TASK

MS-84 Computing tapers

PERFORMANCE OBJECTIVE

Compute tapers in taper per foot (TPF).

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Formula for finding taper per foot (TPF)
b. Taper length formula
c. Finding taper per inch (TPI)

Provide Demonstration On:

a. Computing TPF
b. Converting to TPI
c. Computing taper length

Provide Practical Application On:

From basic dimensions, compute a taper in terms of taper per foot (TPF), taper per inch (TPI) and taper length.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #505-5, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #46
b. Machine Shop Training Course, Vol. I

CLASSROOM HOURS 1

EVALUATION (MS-84)

Given basic dimensions for a tapering operation, the student will be able to make correct computations for taper in terms of taper per foot, taper per inch, and taper length to the instructor's satisfaction.

TASK

MS-85 Measuring short tapers

PERFORMANCE OBJECTIVE

Measure short or abrupt tapers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Angles
    1. Right angle
    2. Acute angle
    3. Obtuse angle
b. Dimensioning of abrupt tapers on mechanical drawings
c. Vernier bevel protractor
d. Sine bar
e. Formula for taper angle for sharp pointed taper
f. Formula for taper angle when TPF is known
g. Vertex of an angle

Provide Demonstration On:

a. Measuring a sharp pointed taper
b. Computing taper from TPF

Provide Practical Application On:

a. Measure a sharp pointed taper.
b. Compute taper given TPF.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #505-5, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #47
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Vernier bevel protractor
b. Sine bar and blocks

CLASSROOM HOURS 5

EVALUATION (MS-85)

a. Given a sharp pointed taper and all necessary measuring tools, the student will be able to correctly measure and compute the taper to the instructor's satisfaction.

b. Given the taper per foot of a taper, the student will be able to correctly compute the taper angle to the instructor's satisfaction.

TASK

MS-86 Gaging inside and outside tapers

PERFORMANCE OBJECTIVE

Gage inside and outside tapers using taper ring and plug gages and micrometers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Gaging tapers
b. Gaging tapered bores
c. Taper plug gage
d. Taper ring gage
e. Using chalk or prussian blue
f. Taper micrometers
    1. Inside
    2. Outside

Provide Demonstration On:

a. Using the plug gage
b. Using the ring gage
c. Using taper micrometers

Provide Practical Application On:

Measure tapers using:
    a. Pluggage
    b. Ring gage
    c. Taper micrometers (inside and outside)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #505-5, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #48

Tools and Equipment:

a. Taper ring and plug gages
b. Taper micrometers

CLASSROOM HOURS 4

EVALUATION (MS-86)

Given an assigned set of inside and outside tapers, the student will be able to measure inside and outside tapers accurately using pluggages, ring gages, inside and outside taper micrometers.

TASK

MS-87 Tapering by the offset tailstock method

PERFORMANCE OBJECTIVE

Turn a taper on the lathe using the offset tailstock method.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of tapers which are turned using offset tailstock method
b. Formulas for offset
    1. Given TPI
    2. Given TPF
    3. General formula
c. Turning a taper between centers
d. Measuring the offset
e. Using the cross slide

Provide Demonstration On:

Turning a taper using the offset tailstock method

Provide Practical Application On:

Turn a taper using the offset tailstock method.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #505-5, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #49
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Lathe
b. Rules
c. Dial indicator
d. Safety goggles

CLASSROOM HOURS 2

EVALUATION (MS-87)

Given all necessary tools, equipment and supplies, the student will be able to turn a taper on the engine lathe using the offset tailstock method to specified dimensions.

TASK

MS-88 Cutting a taper with the compound rest

PERFORMANCE OBJECTIVE

Cut a taper with the compound rest on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Setting the cutting tool on center
b. Compound rest method of cutting a taper
    1. Procedure
    2. Applications
c. Procedure for feeding the tool
d. Positions of zero on compound rest
e. Safety

Provide Demonstration On:

Cutting a taper using the compound rest method

Provide Practical Application On:

Cut a taper on the engine lathe using the compound rest method.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, filmstrip #505-5, "The Lathe Explained"
b. Prentice-Hall Media, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #50
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Engine lathe
b. Workstock
c. Cutting tool
d. Safety goggles
e. Measuring instruments

CLASSROOM HOURS 4

EVALUATION (MS-88)

Given all necessary tools, equipment and materials, the student will be able to cut a taper on the engine lathe using the compound rest method to specified dimensions.

TASK

MS-89 Cutting a taper with the taper attachment

PERFORMANCE OBJECTIVE

Cut a taper on the engine lathe using a taper attachment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The taper attachment
b. Advantages of using the taper attachment
c. Reading graduations on the swivel bar
d. Locking the swivel bar
e. "Lost Motion"

Provide Demonstration On:

a. Setting the swivel bar correctly
b. Making a trial cut

Provide Practical Application On:

Cut a taper on the engine lathe using a taper attachment.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

a. Bergwall, Filmstrip #505-5, "The Lathe Explained"
b. Prentice-Hall Media, Filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #51

Tools and Equipment:

a. Engine lathe
b. Taper attachment
c. Measuring tools

CLASSROOM HOURS

4

EVALUATION (MS-89)

Given all necessary tools, equipment and materials, the student will be able to cut a taper to specified dimensions on the engine lathe using a taper attachment.

TASK

MS-90 Boring or turning internal tapers

PERFORMANCE OBJECTIVE

Bore or turn internal tapers on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Boring internal tapers
   1. Compound slide method
   2. Taper attachment method
b. "Lost motion"
c. Gaging internal taper
d. Finishing internal tapers

Provide Demonstration On:

Boring an internal taper

Provide Practical Application On:

Bore an internal taper to specified dimensions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

A/Vs:

a. Bergwall, Filmstrip #505-5, "The Lathe Explained"
b. Prentice-Hall Media, Filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #52

Tools and Equipment:

a. Engine lathe and cutting tools
b. Workstock
c. Safety goggles
d. Gages

CLASSROOM HOURS

4

EVALUATION (MS-90)

a. Given all necessary tools, equipment and materials, the student will be able to bore and finish an internal taper to specified dimensions.

b. V-TECS, Machine Shop, Task No. 94.

TASK

MS-91 Identifying coolants and cutting components

PERFORMANCE OBJECTIVE

Identify coolants and cutting compounds and be able to choose a coolant or compound for a given job.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Coolants
b. Cutting compounds
c. Functions of a cutting compound
d. Emulsifying or soluble oils
e. Methods of coolant application
f. When to use a coolant or cutting compound

Provide Demonstration On:

a. Choosing a cutting compound
b. Choosing a coolant

Provide Practical Application On:

Choose a coolant or cutting compound for specified lathe work.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

A/Vs:

Prentice-Hall Media, Filmstrip #XF928, "Machine Shop: Engine Lathe:

Student Manuals:

a. Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #53
b. Machine Shop Training Course, Vol. I

Tools and Equipment:

a. Coolant catalog
b. Cutting compound catalog

CLASSROOM HOURS 2

EVALUATION (MS-91)

Given specifications for a specific job to be done on the lathe, the student will be able to identify the appropriate coolant or cutting compound and be able to describe the method or application to the instructor's satisfaction.

TASK

MS-92 Identifying lubricants

PERFORMANCE OBJECTIVE

Identify lubricants and greases used on the engine lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Wear on machine tools
b. Properties of lubricating oils
c. When greases are used
d. Lubricants for ball and roller bearings
e. One-shot lubrication systems
f. Viscosity

Provide Demonstration On:

Choosing a lubricant or grease according to lubrication specifications for an engine lathe

Provide Practical Application On:

Choose a lubricant or grease for an assigned lathe in the lab according to specifications for the machine.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

A/Vs:

Bergwall, filmstrip #XF928, "Machine Shop: Engine Lathe"

Student Manuals:

Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #54

Tools and Equipment:

Manufacturer's lubricant and grease catalog

CLASSROOM HOURS 2

EVALUATION (MS-92)

Given an assigned engine lathe in the lab and lubrication specifications for the machine, the student will be able to correctly choose a lubricator grease for the machine to the instructor's satisfaction.

TASK

MS-93 Identifying turret lathes

PERFORMANCE OBJECTIVE

Identify types, sizes, specifications and nomenclature of turret lathes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Turret lathes
    1. Advantages
    2. Disadvantages
b. Types of turret lathes
c. Special features of the turret lathe
    1. Trip feed
    2. Stop screws
d. Operations which can be performed on the turret lathe
e. Vertical and horizontal types
f. Parts of the turret lathe

Provide Demonstration On:

Identifying and describing parts of the turret lathe

Provide Practical Application On:

Identify a turret lathe as to type and classification and identify the parts and their functions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignemtn Sheet #1

Tools and Equipment:

a. Turret lathe
b. The Warner and Swasey Co., How to Get the Most Out of Your Turret Lathe
c. The Warner and Swasey Co., Production Handbook for Turret Lathes

CLASSROOM HOURS

3

EVALUATION (MS-93)

a. Given a turret lathe, the student will be able to identify the type and classification of the lathe and name and describe the function of the parts of the lathe correctly.

b. V-TECS, Machine Shop, Task No. 111.

TASK

MS-94 Identifying turret lathe safety practices

PERFORMANCE OBJECTIVE

Identify hazards of operating the turret lathe and related safety precautions.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Machine speed
b. Chip guards
c. Personal safety devices, clothing
d. Safe operating procedures for the turret lathe
e. Starting and stopping the machine

Provide Demonstration On:

Identifying safety hazards on the turret lathe

Provide Practical Application On:

Identify safety hazards on the turret lathe and recommend solutions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #2

Tools and Equipment:

Turret lathe

CLASSROOM HOURS 2

EVALUATION (MS-94)

Given a turret lathe, the student will be able to identify safety hazards on the lathe and correctly identify safety precautions related to these hazards.

TASK

MS-95 Maintaining the turret lathe

PERFORMANCE OBJECTIVE

Perform maintenance tasks for proper care of the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cleaning the machine
b. Lubricating the machine
c. Leveling the machine
d. Adjusting clutches
e. Adjusting gibs
f. Shop maintenance schedule
g. Safety

Provide Demonstration On:

Machine Maintenance:
a. Cleaning
b. Lubrication
c. Leveling
d. Clutch adjustment
e. Gib adjustment

Provide Practical Application On:

Machine Maintenance:
a. Clean the lathe
b. Lubricate the lathe
c. Level the lathe
d. Adjust clutches
e. Adjust gibs

INSTRUCTIONAL MATERIALS

Textbooks:

Manufacturer's Service or Maintenance Manual

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #3

Tools and Equipment:

a. Wrenches
b. Rags
c. Cleaning solvents
d. Brushes
e. Lubricants and greases

CLASSROOM HOURS	2

EVALUATION (MS-95)

Given a turret lathe and service manual and all necessary tools and supplies, the student will be able to perform the following maintenance on the lathe following correct procedure:

a. Cleaning
b. Lubrication
c. Leveling
d. Clutch adjustment
e. Gib adjustment

TASK

MS-96 Identifying workholding devices

PERFORMANCE OBJECTIVE

Identify workholding devices on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Collet chuck
b. Three-jaw chuck
c. Four-jaw chuck
d. Bar chucks
e. Parallel closing type collet chuck
f. Spring type collets
    1. Push out type
    2. Draw back type
    3. Stationary type
g. Power operated collet chuck
h. Arbors
    1. Expanding bushing
    2. Expanding plug
    3. Threaded arbors

Provide Demonstration On:

Identifying chucks, collets and arbors on the turret lathe

Provide Practical Application On:

Identify type of chucks, collets and arbors used on the turret lathe in the lab.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #4

Tools and Equipment:

a. Collets
b. Chucks
c. Arbors

CLASSROOM HOURS

2

EVALUATION (MS-96)

Given various types of workholding devices on the turret lathe, the student will be able to identify the type of collet, chuck or arbor and describe its function to the satisfaction of the instructor.

TASK

MS-97 Identifying chucking operations on the turret lathe

PERFORMANCE OBJECTIVE

Identify types of chucks and procedures for chucking operations on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Choosing a holding device for chucking work
b. Purpose of holding devices in chucking
c. Types of chucks
    1. Universal
    2. Independent
    3. Combination
    4. Power operated types
d. Other chucks
    1. Two-jaw box, universal
    2. Revolving jaw chuck
e. Chuck jaws
f. Mounting a chuck
g. Second operation chucks

Provide Demonstration On:

Choosing and mounting a chuck

Provide Practical Application On:

Choose an appropriate chuck and mount it on the turret lathe for a specified job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #5

Tools and Equipment:

a. Chucks
b. Hard tools

CLASSROOM HOURS 2

EVALUATION (MS-97)

Given a turret lathe and an assigned job, the student will be able to choose the correct chuck for the job and mount the chuck according to correct procedure.

TASK

MS-98 Identifying special fixtures and steady rests

PERFORMANCE OBJECTIVE

Identify special fixtures and steady rests on turret lathes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of special fixtures
b. Types of special fixtures
c. Mounting fixtures on face plates
d. Pot fixtures
e. Angle type fixtures
f. Rotating index fixture
g. Using steady rests for long parts
h. Self-centering type steady rests

Provide Demonstration On:

a. Identifying and mounting special fixtures on the face plate of a turret lathe
b. Using the steady rest

Provide Practical Application On:

a. For an assigned special fixture, mount it on the face plate of a turret lathe and identify its application.
b. Use the steady.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #6

Tools and Equipment:

a. Special turret lathe fixtures
b. Turret lathe
c. Face plate
d. Wrenches
e. Steady rest

CLASSROOM HOURS

4

EVALUATION (MS-98)

a. Given an assigned special fixture and a turret lathe, the student will be able to correctly identify the type of fixture and mount it correctly on the face plate.

b. Given a turret lathe job for a long workpiece the student will be able to correctly set up the workpiece using the center rest.

TASK

MS-99 Identifying standard tool holding devices

PERFORMANCE OBJECTIVE

Identify standard tool holding devices used on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Objectives of a turret lathe job
b. Elements of production time
c. Universal Tooling Equipment
d. Indexing
e. Arrangement of tools
f. Types of tools (description and application)
g. Precautions

Provide Demonstration On:

Setting up tool holding devices on the turret lathe

Provide Practical Application On:

Identify standard turret lathe tool holding devices in the lab

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #7

Tools and Equipment:

Standard tool holding devices

CLASSROOM HOURS	1

EVALUATION (MS-99)

Given a total of fifteen standard tool holding devices for the turret lathe, the student will be able to identify and describe correct by at least twelve to the instructor's satisfaction.

TASK

MS-100 Identifying principles of tool grinding

PERFORMANCE OBJECTIVE

Identify basic principles of tool grinding on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Speeds and feeds
b. Types of material
c. Types of high-speed steel
d. Cutter applications
e. Cutter sizes
f. Cutter grinding
g. Lubrication
h. Procedure for grinding a cutter

Provide Demonstration On:

Grinding a cutter to correct angle

Provide Practical Application On:

Grind a cutting tool to the correct angle for a given material.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #8

Tools and Equipment:

a. Cutting tool
b. Pedestal grinder
c. Safety goggles
d. Measuring tools

CLASSROOM HOURS

4

EVALUATION (MS-100)

Given specifications for a cutting job on the turret lathe, the student will be able to grind (wet or dry, as appropriate) a cutting tool to an acceptable angle for the material to be cut to the instructor's satisfaction.

TASK

MS-101 Selecting cutting speed and feed on the turret lathe

PERFORMANCE OBJECTIVE

Select cutting speed and feed for an assigned job on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Factors which affect speed and feed
b. Setting exact speed and feed (test)
c. Type of finish required
d. Quantity of parts to make vs. speed

Provide Demonstration On,

Determining speeds and feeds on the turret lathe

Provide Practical Application On:

Set the turret lathe speeds and feeds for an assigned job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #9

Tools and Equipment:

a. Turret lathe
b. Work piece

CLASSROOM HOURS	3

EVALUATION (MS-101)

Given an assigned job on the turret lathe and all necessary equipment, tools and materials, the student will be able to set the speed and feed of the machine correctly for the given material. The instructor will evaluate the student's settings.

TASK

MS-102 Identifying coolants and cutting compounds

PERFORMANCE OBJECTIVE

Identify coolants and cutting compounds used on turret lathe jobs.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of coolants
b. Coolants and accuracy
c. Procedure for using a coolant
d. Coolants recommended for various materials

Provide Demonstration On:

Choosing a coolant (or cutting compound) for an assigned material

Provide Practical Application On:

Choose an appropriate coolant or cutting compound for an assigned material.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, *Machine Trades I*, Turret Lathe Assignment Sheet #10

Tools and Equipment:

a. Manufacturer's catalogs
b. Work pieces (various types of material)

CLASSROOM HOURS

2

EVALUATION (MS-102)

Given an assigned material to cut, the student will be able to select an appropriate coolant or cutting compound for the material to the instructor's satisfaction.

TASK

MS-103 Facing on the turret lathe

PERFORMANCE OBJECTIVE

Perform facing operations on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Facing
b. Facing tools
c. Direction of cut for finish facing
d. Grinding the facing tool
e. Facing problems
f. Choosing the appropriate turret
g. Setting up the turret lathe for facing

Provide Demonstration On:

a. Grinding the facing tool
b. Setting up the turret lathe for facing

Provide Practical Application On:

Set up and operate the turret lathe to finish face a workpiece to specified dimensions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #11

Tools and Equipment:

a. Turret lathe
b. Facing tool
c. Workpiece
d. Pedestal grinder
e. Safety goggles

CLASSROOM HOURS 2

EVALUATION (MS-103)

Given specifications and all necessary equipment, supplies and materials, the student will be able to set up the turret lathe to face a given workpiece to specified dimensions and finish, observing all safety precautions.

TASK

MS-104 Using face plates

PERFORMANCE OBJECTIVE

Use a face plate on a turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Mounting of the face plate
b. Types and sizes of face plates
c. Mounting indexing fixtures
d. Advantages of face plates

Provide Demonstration On:

Mounting a face plate on a turret lathe.

Provide Practical Application On:

Mount a face plate on a turret lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #12

Tools and Equipment:

a. Turret lathe
b. Face plates
c. Wrenches
d. Safety goggles
e. T-bolts

CLASSROOM HOURS

3

EVALUATION (MS-104)

Given a turret lathe, face plate and necessary tools, the student will be able to follow correct procedure for mounting the face plate to the instructor's satisfaction.

TASK

MS-105 Forming on the turret lathe

PERFORMANCE OBJECTIVE

Perform forming operations on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Forming
b. Combining cuts with a forming cutter
c. Types of forming cutters
d. Advantages of dovetail cutters
e. Grinding a forming cutter
f. Materials which can be form cut
g. Finish forming
h. Using coolants
i. Procedure for form cutting
j. Safety

Provide Demonstration On:

Choosing a forming cutter for a job

Provide Practical Application On:

Form cut an assigned workpiece to specified dimensions on the engine lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #13

Tools and Equipment:

a. Turret lathe
b. Form-cutting tools
c. Coolant
d. Safety goggles

CLASSROOM HOURS

4

EVALUATION (MS-105)

Given specifications and all necessary equipment, tools and materials, the student will be able to form cut an assigned workpiece on the turret lathe to specified dimensions.

TASK

MS-106 Turning on the turret lathe

PERFORMANCE OBJECTIVE

Perform turning operations on the turret lathe

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cutter bar turners
b. Angles of bar turner cutters
c. Positioning and adjustment of rolls
d. Hexagon turret
e. Steady or roller rest
f. Purpose of rollers on the rest
g. V-back rests
h. Using the withdrawal lever
i. Grinding cutters
j. Using grinding gauges

Provide Demonstration On:

a. Grinding cutters and using gages to check angles
b. Setting up bar turner cutters on the turret lathe

Provide Practical Application On:

Grind cutters to correct angles and set up the bar turner cutters on the turret lathe to turn an assigned workpiece to specified dimensions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Assignment Sheet #14

Tools and Equipment:

a. Turret lathe
b. Bar turner cutters
c. Pedestal grinder
d. Gages
e. Safety goggles

CLASSROOM HOURS

5

EVALUATION (MS-106)

Given all necessary equipment, tools and materials, the student will be able to follow correct procedure to set up the turret lathe to turn an assigned workpiece to specified dimensions.

TASK

MS-107 Drilling on the turret lathe

PERFORMANCE OBJECTIVE

Perform drilling operations on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Drills
b. Producing accurate holes
c. Starting drills
d. Drill holding devices
e. Grinding a drill
f. Speeds and feeds of the spindle
g. Using turpentine or kerosene (hard materials)
h. Drilling brass
i. Safety

Provide Demonstration On:

Drilling on the turret lathe

Provide Practical Application On:

Drill a hole in an assigned workpiece to specified dimensions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I,
Turret Lathe Work
Assignment Sheet #15

Tools and Equipment:

a. Turret lathe
b. Drill bits and holding devices
c. Gages
d. Tools
e. Workpiece
f. Safety goggles
g. Cleveland Twist Drill Company pamphlet

CLASSROOM HOURS 3

EVALUATION (MS-107)

Given all necessary equipment, tools and materials, the student will be able to drill a hole in an assigned workpiece on the turret lathe to specified dimensions following all safety precautions.

TASK

MS-108 Boring on the turret lathe

PERFORMANCE OBJECTIVE

Perform boring operations on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Boring cutters
b. Boring drilled holes
c. Using boring cutters to ream holes
d. Types of boring cutters
e. Types of boring bars
f. Using a boring bar
g. Sleeves
h. Hexagon turret (advantages)
i. Slide tools
j. Adjustable boring cutter holder
k. Double-end cutters
l. Procedure for boring
m. Safety

Provide Demonstration On:

Boring on the turret lathe

Provide Practical Application On:

Bore a drilled hole on the turret lathe to specified dimensions.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #16

Tools and Equipment:

a. Turret lathe
b. Boring tools
c. Gages
d. Workpiece
e. Safety goggles

CLASSROOM HOURS

4

EVALUATION (MS-108)

Given all necessary equipment tools and materials, the student will be able to bore a drilled hole in an assigned workpiece to specified dimensions observing all safety precautions.

TASK

MS-109 Reaming on the turret lathe

PERFORMANCE OBJECTIVE

Perform reaming operations on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Reamers
b. Types of reamers
c. Reamer holders
d. Procedure for starting a reamer
e. Block type and two-bladed reamers
f. Grinding a reamer
g. Safety

Provide Demonstration On:

a. Aligning a reamer and starting a reamer
b. Grinding a reamer

Provide Practical Application On:

Ream a drilled hole to specified dimensions on the turret lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #17

Tools and Equipment:

a. Turret lathe
b. Reamers
c. Gages
d. Safety goggles
e. Cleveland Twist Drill Company reamer pamphlet

CLASSROOM HOURS

3

EVALUATION (MS-109)

Given all necessary equipment tools and materials, the student will be able to ream a drilled hole to specified dimensions in an assigned workpiece observing all safety precautions.

TASK

MS-110 Taper turning on the turret lathe

PERFORMANCE OBJECTIVE

Turn tapers on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Methods of tapering
b. Choosing a method
c. Tapering procedures
d. Backlash points
e. Eliminating backlash
f. Direction of feed for a taper cut
g. Taper threads

Provide Demonstration On:

a. Choosing a method for taper turning
b. Turning a taper on the taper lathe

Provide Practical Application On:

Choose the best method and turn a taper to specified dimensions on the turret lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #18

Tools and Equipment:

a. Turret lathe
b. Tapering tools
c. Gages
d. Safety goggles

CLASSROOM HOURS

2

EVALUATION (MS-110)

Given all necessary equipment, tools and materials, the student will be able to turn a taper on the turret lathe to specified dimensions, choosing the best method to the satisfaction of the instructor.

TASK

MS-111 Chamfering and grooving on the turret lathe

PERFORMANCE OBJECTIVE

Perform chamfering and grooving operations on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Chamfering on the turret lathe
b. Chamfering tools
c. Using a cut-off tool
d. Using threading tools
e. Grooving
f. Safety

Provide Demonstration On:

a. Cutting a chamfer
b. Cutting a groove

Provide Practical Application On:

Cut a chamfer or groove to specified dimensions with a given tool on the turret lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #19

Tools and Equipment:

a. Turret lathe
b. Cutting tools
c. Gages
d. Safety goggles

CLASSROOM HOURS 3

EVALUATION (MS-111)

Given a turret lathe already set up with a turning, facing, cut-off or threading tool, the student will be able to cut either a chamfer or groove to specified dimensions on an assigned workpiece observing all safety precautions.

TASK

MS-112 Threading on the turret lathe

PERFORMANCE OBJECTIVE

Perform threading operations on the turret lathe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Dies
b. Taps
c. Chasing attachments
d. Cutting threads on the turret
e. Cutting large threads with single point tools
f. Leading-on attachments
g. Types of taps and dies
h. Mounting die heads
i. Making roughing and finishing cuts
j. Roughing and finishing attachments
k. Safety

Provide Demonstration On:

Cutting threads on a turret lathe

Provide Practical Application On:

Cut threads to specified dimensions on the turret lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #20

Tools and Equipment:

a. Turret lathe
b. Threading tools
c. Gages
d. Safety goggles

CLASSROOM HOURS 4

EVALUATION (MS-112)

Given all necessary equipment, tools and materials, the student will be able to cut threads to specified dimensions on an assigned workpiece with the turret lathe observing all safety precautions.

TASK

MS-113 Identifying power cut-off saws

PERFORMANCE OBJECTIVE

Identify power cut-off saws by types, sizes, nomenclature and range of work.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sizing of a power cut-off
b. Cut of the blade
c. Mounting material in the vise
d. Blade maintenance
e. Safety

Provide Demonstration On:

Determining the size (range) of a power cut-off saw

Provide Practical Application On:

Determine the size of a power cut-off saw and identify its cutting capability and use.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Porter
c. Kibbe

Student Manuals:

Ohio, Machine Trades I, Power Saw Work Assignment Sheet #1

Tools and Equipment:

Power saws, several different types (or pictures)

CLASSROOM HOURS 2

EVALUATION MS-113

Given a power cut-off saw, the student will be able to identify the size and type of saw and describe its cutting action to the instructor's satisfaction.

TASK

MS-114 Identifying power saw safety

PERFORMANCE OBJECTIVE

Identify safe practices and work habits on the power saw.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Belt and pulley guards
b. Loose clothing
c. Jewelry
d. Hair
e. Cutting short pieces
f. Cutting in an old cut with a new blade
g. Personal safety gear

Provide Demonstration On:

Safe use of the power saw

Provide Practical Application On:

Name at least six safety hazards when using a power saw.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

Student Manuals:

Ohio, Machine Trades I, Power Saw Work Assignment Sheet #2

CLASSROOM HOURS 1

EVALUATION (MS-114)

Given a power saw, the student will be able to identify and describe at least six safety hazards or precautions when using the saw to the instructor's satisfaction.

TASK

MS-115 Identifying and using work holding devices on the power cut-off saw

PERFORMANCE OBJECTIVE

Identify types of work holding devices used on the power cut-off saw.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Positioning flat stock in the vise
b. Types and sizes of vises
c. Importance of holding work securely in the vise
d. Cutting more than one piece
e. Angular cutting

Provide Demonstration On:

Positioning workpiece in the vise correctly

Provide Practical Application On:

Position a given workpiece in the vise correctly and identify the type and size of vise.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

Student Manuals:

Ohio, Machine Trades I, Power Saw Work Assignment Sheet #3

Tools and Equipment:

a. Power saw
b. Work holding devices

CLASSROOM HOURS

4

EVALUATION (MS-115)

Given a power cut-off saw and an assigned workpiece, the student will be able to correctly position the workpiece in the vise to the instructor's satisfaction.

TASK

MS-116 Identifying, selecting, mounting and maintaining saw blades

PERFORMANCE OBJECTIVE

Identify, select, mount and maintain saw blades.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Hack saw blades
b. "All hard" blades
c. "Flexible" blade
d. Saw blade tooth patterns
e. Application of saw blades
f. Blade maintenance

Provide Demonstration On:

Choosing a blade for job

Provide Practical Application On:

Choose the correct type of blade for an assigned job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe
c. Porter

Student Manuals:

Ohio: Machine Trades I, Power Saw Work Assignment Sheet #4

Tools and Equipment:

a. Saw blades
b. Catalogs for saw blades

CLASSROOM HOURS

1

EVALUATION (MS-116)

Given an assigned job on the power cut-off saw, the student will be able to select an appropriate saw blade for the job to the instructor's satisfaction.

TASK

MS-117 Identifying speeds, feeds and coolants for power cut-off saws

PERFORMANCE OBJECTIVE

Identify and be able to calculate speeds, feeds and requirements for coolants for the power cut-off saws.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Coolants
b. Cutting speed (strokes per minute)
c. Cutting feed (feed per minute)
d. Operating a saw without coolant
e. Applying coolant

Provide Demonstration On:

Determining feeds, speeds and coolant requirements for a given job

Provide Practical Application On:

Calculate feed, speed and requirement for a coolant for an assigned job on the power cut-off saw and make a specified cut.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

A/Vs:

Bergwall, filmstrip #505-2, "Bench Metalwork"

Student Manuals:

Ohio, Machine Trades I, Power Saw Work Assignment Sheet #6

Tools and Equipment:

a. Power saw
b. Workpiece
c. Coolant
d. Manufacturer's speed recommendations for saw

CLASSROOM HOURS

2

EVALUATION (MS-117)

a. Given a power cut-off saw, specifications and all necessary tools and materials, the student will able to calculate the appropraite feed and speed for the job and determine coolant requirements if any and make a specified cut following all safety precautions.

b. V-TECS, Machine Shop, Task No. 145.

TASK

MS-118 Using the power cut-off saw for straight and angular sawing

PERFORMANCE OBJECTIVE

Set up and use the power cut-off saw to perform straight and angular operations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Leaving extra length when cutting off material
b. Dull blades
c. Straight cuts
d. Angle cuts
e. Sawing pipe or tube
f. When to change blades
g. Safety

Provide Demonstration On:

Cutting straight and angular cuts on the power hack saw

Provide Practical Application On:

Make an assigned straight or angular cut on the power hack saw.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part I
b. Kibbe

A/Vs:

Bergwall, filmstrip #505-2, "Bench Metalwork"

Student Manuals:

Ohio, Machine Trades I, Power Saw Work Assignment Sheet #6

Tools and Equipment:

a. Power hack saw
b. Blades
c. Work stock
d. Safety goggles

CLASSROOM HOURS 2

EVALUATION (MS-118)

a. Given a power hacksaw, specifications, all necessary tools and materials, and an assigned workpiece, the student will be able to cut the workpiece to specified dimensions observing all safety practices.

b. V-TECS, Machine Shop, Task No. 144.

TASK

MS-119 Identifying the metal band saw

PERFORMANCE OBJECTIVE

Identify types of metal band saws and ranges of work.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of metal cutting band saws
b. Types of materials which are out on the band saw
c. Operating the feed
d. Work capacity

Provide Demonstration On:

Operating the feed on the metal band saw

Provide Practical Application On:

Identify the metal band saw and be able to operate the feed and set it for an assigned job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

A/Vs:

Bergwall, Filmstrip #505-2, "Bench Metalwork"

Student Manuals:

Ohio: Machine Trades I, Power Saw Work Assignment Sheet #7

Tools and Equipment:

a. Metal band saw
b. The Do All Company, Band Tool Manual

CLASSROOM HOURS

2

EVALUATION (MS-119)

Given a metal band saw, the student will be able to identify the saw in the lab and set the feed on the saw for an assigned job to the instructor's satisfaction.

TASK

MS-120 Identifying coolants and lubricating agents for band saws

PERFORMANCE OBJECTIVE

Identify coolants and lubricating agents used for band saw work.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of coolants and lubricants
b. Applying lubricant
c. Materials which require a lubricant
d. Diamond tooth band tools

Provide Demonstration On:

Choosing a coolant for a given job

Provide Practical Application On:

Choose an appropriate coolant for an assigned job on the power band saw.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

A/Vs:

Bergwall, Filmstrip #505-2, "Metal Benchwork"

Student Manuals:

Ohio: Machine Trades I, Power Saw Work Assignment Sheet #8

Tools and Equipment:

a. Power band saw
b. Coolants
c. The Do All Company, Band Tool Manual

CLASSROOM HOURS

2

EVALUATION (MS-120)

Given an assigned job on the power band saw, the student will be able to choose an appropriate lubricant for the job, if required, and describe the method of lubricant application correctly.

TASK

MS-121 Choosing saw blades for the metal band saw

PERFORMANCE OBJECTIVE

Choose saw blades for the metal band saw for specific jobs.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Band saw blade types
b. Choosing a blade type for a job
c. Using precision blades
d. Using friction sawing blades
e. Using buttress blade
f. Claw-tooth blade
g. Knife edge blade
h. Spiral edge blade

Provide Demonstration On:

Choosing a band saw blade for an assigned job

Provide Practical Application On:

Choose a band saw blade for an assigned job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

A/Vs:

Bergwall, Filmstrip #505-2, "Bench Metalwork"

Student Manuals:

Ohio: Machine Trades I, Power Saw Work Assignment Sheet #9

Tools and Equipment:

a. Band saw blades, several types
b. The Do All Company, Band Tool Manual

CLASSROOM HOURS

2

EVALUATION (MS-121)

a. Given an assigned job on the metal band saw, the student will be able to choose the correct type of metal band saw blade for the job to the instructor's satisfaction.

b. V-TECS, Machine Shop, Task No. 146.

TASK

MS-122 Calculating feeds and speeds for metal band saw

PERFORMANCE OBJECTIVE

Calculating feeds and speeds for jobs on the metal band saw.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Speed ranges of a metal
b. Applying pressure to the work
c. Results of incorrect speeds
d. Method of feeding
e. Adjusting feed rate
f. Adjusting the speed

Provide Demonstration On:

Adjusting the feed and speed of the power band saw

Provide Practical Application On:

Adjust the feed and speed of the power band saw for an assigned job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

A/Vs:

Bergwall, Filmstrip #505-2, "Bench Metalwork"

Student Manuals:

Ohio: Machine Trades I, Power Saw Work Assignment Sheet #10

Tools and Equipment:

a. Power band saw
b. The Do All Company, Band Tool Manual

CLASSROOM HOURS

2

EVALUATION (MS-122)

a. Given an assigned job on the power band saw, the student will be able to set the correct feed and speed for the job to the instructor's satisfaction.

b. V-TECS, Machine Shop, Task No. 145.

TASK

MS-123 Identifying types, sizes, construction, specifications, nomenclature and range of work for shapers

PERFORMANCE OBJECTIVE

Recognize types and sizes of shapers and what kind of work they do.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function of the shaper and cuts that can be made
b. Ram motion
c. Determination of size of shaper and type (Horizontal or Vertical)
d. Ratchet and paw/ mechanism
e. Work table
f. Clapper
g. Apron
h. Power rapid-traverse lever
i. Gib and gib adjustments
j. Coolants and cutting fluids

Provide Demonstration On:

Identifying parts and components of the shaper

Provide Practical Application On:

Identify parts and function of the shaper.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Shaper Assignment Sheet #2, 13, 14

Tools and Equipment:

a. Shaper
b. Display of work done on a shaper

CLASSROOM HOURS

6

EVALUATION (MS-123)

a. Given a shaper with parts marked or tagged, the student will identify each tagged part and describe the function of each. 100 percent accuracy is required.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-124 Identifying shaper work holding devices and their function

PERFORMANCE OBJECTIVE

Identify and describe the function of work holding devices.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Angle plates
b. Parallels
c. Hold-down (grippers)
d. Toe dogs
e. Clamps
f. Vises
g. V-blocks
h. T-slots on table
i. Jacks

Provide Demonstration On:

Identifying hold down devices

Provide Practical Application On:

Identify and match work holding devices with specific work requirements.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Shaper Assignment Sheet #3

Tools and Equipment:

a. Shaper
b. Various holding devices

CLASSROOM HOURS

4

EVALUATION (MS-124)

a. Given a shaper and work holding devices, the student will identify each device and describe the type of work the device is used with. 100 percent accuracy is required.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-125 Identifying shaper cutting tools, grinding them and attaching to machine

PERFORMANCE OBJECTIVE

Identify, grind and attach cutting tools to the shaper.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Left and right hand tools
b. Roughing tools
c. Finishing tools
d. Parting tools (slotting)
e. Dove tail tools
f. Tool holders
g. Clearance angles
h. Cutting angles
i. Rake
j. Tool post and clapper plate

Provide Demonstration On:

a. Selecting a tool and holder for a specific job
b. Grinding or sharpening and installing the tool on the machine

Provide Practical Application On:

a. Make cutter selection
    1. Identify workpiece material.
    2. Determine type of cut (roughing or finishing)
    3. Determine profile of cutter to perform machining operation.
    4. Select proper cutter

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy

Student Manuals:

Ohio, Machine Trades II, Shaper Assignment Sheet #4

Tools and Equipment:

a. Cutting tools
b. Holders
c. Shaper

CLASSROOM HOURS

4

EVALUATION (MS-125)

a. Given a shaper and cutting tools, the student will select a cutting tool for a given job, grind the tool to specifications and install in the correct holder. One hundred percent accuracy is required.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 155.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

b. Shape and sharpen cutting tool:
   1. Repeat steps 1 - 3 (item a) on previous page.
   2. Select cutter that is appropriate to the job and that fits toolholder.
   3. Check and dress grinding wheel.
   4. Grind tool to rough desired shape (use coolants as necessary).
   5. Measure to determine finish cuts.
   6. Grind tool to desired specifications and sharpen.

TASK

MS-126 Setting up the shaper and calculating speed and feed

PERFORMANCE OBJECTIVE

Set up the shaper and calculate cutting feed and speed.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Speed and feed
b. Strokes per minute (SPM) and feet per minute (FPM)
c. Cutting stroke and return stroke
d. Rough and finish cuts
e. Calculating cutting speed and feed for types of metal, amount to be removed, and cutting tool used
f. Rocker arm adjustment
g. Table feed

Provide Demonstration On:

Calculate cutting speed and feed speed and setting up the shaper for a given job

Provide Practical Application On:

a. Select and set machine speed.
    1. Identify and classify workpiece material.
    2. Determine desired cutting speed by using formula or table.
    3. By using formula, approximate the machine speed in cutting strokes per minute.

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, *Machine Trades II*, Shaper Assignment Sheet #5

Tools and Equipment:

a. Shaper
b. Selection of tools and holders
c. Cutting material
d. *Machinist's Handbook*

CLASSROOM HOURS

8

EVALUATION (MS-126)

a. Given a shaper and necessary tools and equipment, the student will calculate speed and feed for a given job and set the machine up, calculations must be within ten percent of instructors and set up must conform to Machinist Handbook.

b. Ohio, Machine Trades II, Instructor Manual.

c. V'TECS, Machine Shop, Task No. 154.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

    4. Set driving gear or bull wheel to proper machine speed.
- b. Select and set for cutting speed.
    1. Identify and classify material of workpiece.
    2. Identify cutter material to be used.
    3. Determine cutting speed by using table specifications.
    4. Determine setting of cutting speed based on desired length of cut and shaper strokes per minute.
    5. Set shaper for desired cutting speed by using operations manual.
- c. Select and set feed.
    1. Identify and classify material of workpiece.
    2. Identify cutter material.
    3. Determine cutting speed.
    4. Determine depth of cut needed.
    5. Determine feed according to desired finish.
    6. Set feed according to operations manual.

TASK

MS-127 Adjusting the shaper

PERFORMANCE OBJECTIVE

Set up and adjust the shaper for a specific job.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Stock length and shaper stroke
b. Final checks
c. Position of tool slide
d. Clapper box and tool clearance
e. Position of work in holder
f. Testing for parallelism and squareness
g. Seating work in the vise
h. Paper shimming
i. Aligning the angle plate
j. Adjusting the ram for position and length of stroke
k. Adjusting the table

Provide Demonstration On:

Setting up the shaper for a given job

Provide Practical Application On:

a. Secure holding device.
b. Mount and align key stock.
c. Square workpiece to ram head.
d. Replace key stock with workpiece.
e. Adjust shaper and cutter to workpiece
    1. Adjust clapper box
    2. Adjust for clearance
    3. Adjust for length of stroke

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, *Machine Trades II*, Shaper Assignment Sheet #6

Tools and Equipment:

a. Shaper
b. Tools and holders
c. Measuring tools
d. *Machinist's Handbook*

CLASSROOM HOURS

5½

EVALUATION (MS-127)

a. Given a shaper and necessary tools and equipment to perform a given job, the student will set up the shaper, align shaper attachments, workpiece, and cutter. Cutting tool heel and side clearance must be within 4°. Ram stroke must clear workpiece on forward stroke by 1/4", and 1/2" on return stroke.

b. Ohio, Machine Trades II, Instructor Manual.

c. V'TECS, Machine Shop, Task No. 153.

TASK

MS-128 Performing a horizontal shaping operation

PERFORMANCE OBJECTIVE

Make a rough and a finish horizontal cut.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Selecting cutting tool
b. Placing stock and adjusting parallels
c. Adjusting rough cut
d. Adjusting finish cut
e. Importance of maintaining free clapper
f. Clapper box angle in relation to feed

Provide Demonstration On:

Setting up machine and making a horizontal cut

Provide Practical Application On:

Set up the machine and make a rough and a finished horizontal cut.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Shaper Assignment Sheet #7

Tools and Equipment:

a. Shaper
b. Cutting stock
c. Tools and holders
d. Measuring tools
e. Machinist's Handbook

CLASSROOM HOURS

5

EVALUATION (MS-128)

a. Given a shaper and necessary tools and equipment, the student will set up the machine and make a horizontal cut to given dimensions. Work must be within tolerances specified by the instructor.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-129 Performing a vertical shaping operation

PERFORMANCE OBJECTIVE

Make a rough and a finished vertical cut.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Selection of cutting tool
b. Positioning the apron, stock and clapper box
c. Operations requiring vertical cuts
d. Automatic and hand feeding
e. Difference between horizontal and vertical cuts
f. Adjusting for rough and finished cuts

Provide Demonstration On:

Setting up machine and making a vertical cut

Provide Practical Application On:

Set up machine and make a rough and a finished vertical cut.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, *Machine Trades II*, Shaper Assignment Sheet #8

Tools and Equipment:

a. Shaper
b. Cutting stock
c. Tools and holders
d. Measuring tools
e. *Machinist's Handbook*

CLASSROOM HOURS

5

EVALUATION (MS-129)

a. Given a shaper and necessary tools and equipment, the student will set up the machine and make a vertical cut to given dimensions. Work must be within tolerance specified by the instructor.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-130 Shaping a rectangle or square

PERFORMANCE OBJECTIVE

Accurately machine a rectangle or square on all surfaces.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Selecting the cutting tool
b. Positioning stock
c. Using the solid jaw vise
d. Checking for accuracy
e. Using a small strip of steel to help bring the work piece to parallel
f. Reading the job specifications

Provide Demonstration On:

Setting up machine for shaping a square

Provide Practical Application On:

Set up and shape a square or rectangle of given specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Shaper Assignment Sheet #9

Tools and Equipment:

a. Shaper
b. Stock
c. Tools and holders
d. Measuring tools
e. Machinist's Handbook

CLASSROOM HOURS

4

EVALUATION (MS-130)

a. Given a shaper and necessary tools and equipment, the student will set up the shaper and machine a square block to a tolerance of ± 0.0001".

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-131 Shaping a contour

PERFORMANCE OBJECTIVE

Accurately machine a contour surface.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Lay out
b. Selecting and grinding the cutting tool
c. Positioning stock in holder
d. Rough cut
e. Finish cut

Provide Demonstration On:

Setting up machine and shaping a contour

Provide Practical Application On:

Set up and shape a contour of given specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Shaper Assignment Sheet #10

Tools and Equipment:

a. Shaper
b. Stock
c. Tools and holders
d. Measuring tools
e. Machinist's Handbook

CLASSROOM HOURS

3½

EVALUATION (MS-131)

a. Given a shaper and necessary tools and equipment, the student will set up the shaper and machine a contour to a tolerance of ± 0.001".

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-132 Performing angular shaping and dovetailing operations

PERFORMANCE OBJECTIVE

Accurately machine a compound angle and a dove tail.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Angular surfaces
b. Setting up work for angular cutting
c. Swiveling clapper box
d. Positioning the head
e. Compound angles
f. Dove tails
g. Measuring dove tails
h. Setting up for dove tails

Provide Demonstration On:

a. Setting up and cutting a compound angle
b. Setting up and cutting a dove tail

Provide Practical Application On:

Cut a compound angle and a dove tail to given specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Shaper Assignment Sheet #11

Tools and Equipment:

a. Shaper
b. Stock
c. Tools and holders
d. Measuring tools
e. Machinist's Handbook

CLASSROOM HOURS 5

EVALUATION (MS-132)

a. Given a shaper and necessary tools and equipment, the student will set up the shaper and machine a compount angle and a dovetail to a tolerance of ± 0.001".

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-133 Cutting internal and external slots and keyways and cutting off in the shaper

PERFORMANCE OBJECTIVE

Accurately machine an internal and external slot, a keyway and cut off stock in shaper.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Back lash
b. Slack screw controlling down feed
c. Blind key ways
d. Drilling holes to relieve cutting tool
e. Selecting and grinding the cutting tool
f. Selecting a tool holder
g. Cutting off operations
h. Acquiring proper depth of keyway in a round shaft

Provide Demonstration On:

a. Setting up and cutting a keyway
b. Cutting off stock in the shaper

Provide Practical Application On:

Cut a keyway, an external slot and cut off stock.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Shaper Assignment Sheet #12

Tools and Equipment:

a. Shaper
b. Stock
c. Tools and holders
d. Measuring tools
e. Machinist's Handbook

CLASSROOM HOURS

5

EVALUATION (MS-133)

a. Given a shaper and necessary tools and equipment, the student will set up the shaper and machine an internal slot, an external slot, a keyway in round stock and cut off stock. All work must be done to a tolerance of ± 0.001".

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-134 Maintaining and caring for the shaper

PERFORMANCE OBJECTIVE

Provide daily lubrication, adjustment of the gibs and major oil change.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cleaning the shaper
b. Lubricating
c. Major oil change
d. Adjustments
e. Inspection

Provide Demonstration On:

Daily maintenance and adjustments

Provide Practical Application On:

Clean and care for the shaper as it is used.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Kibbe

Student Manuals:

Ohio, Machine Trades II, Shaper Assignment Sheet #15

Tools and Equipment:

a. Manufacturer's lubrication chart
b. Hand tools and equipment for changing oil and adjusting
c. Brush

CLASSROOM HOURS 1½

EVALUATION (MS-134)

a. Given a shaper, the student will clean, lubricate and adjust it according to manufacturer's specifications.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-135 Identifying types, sizes, construction, specifications, nomenclature and range of work for planers

PERFORMANCE OBJECTIVE

Recognize types and sizes of planers and what kind of work they do.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Comparison of planer to shapers
b. Types of planers
c. Sizes of planers
d. Types of work done on planers
e. The platen
f. Platen drive
    1. Rack and gear
    2. Helical gear
    3. Hydraulic system
g. Feed rod tool
h. Crossrail
i. Tripping dogs
j. Size and number of tool heads

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Kibbe

Student Manuals:

Ohio, Machine Trades II, Work Assignment Sheet #1

Tools and Equipment:

a. Planer
b. Display of work done on a planer

CLASSROOM HOURS 10

EVALUATION (MS-135)

a. Given a planer with parts tagged, the student will identify each tagged part, describe the function and its counterpart on a shaper (if any). 100 per cent accuracy is required.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-136 Identifying and using work holding and clamping devices

PERFORMANCE OBJECTIVE

Select the correct holding device for a specific job.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Bolts
b. Clamps
c. Blocks
d. Jacks
e. Braces
f. Poppets
g. Stops
h. Toe dogs
i. V blocks
j. Angle plates

Provide Demonstration On:

Mounting stock on planer

Provide Practical Application On:

Mount stock on planer.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Work Assignment Sheet #4

Tools and Equipment:

a. Planer
b. Work holding devices
c. Stock
d. Machinist's Handbook

CLASSROOM HOURS

3

EVALUATION (MS-136)

a. Given a planer and work holding devices, the student will identify and select a device for a given project. The stock must be mounted on the planer according to the Machinist's Handbook.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-137 Identifying planer cutting tools, grinding them and attaching to machine

PERFORMANCE OBJECTIVE

Identify, grind and attach cutting tools to the planer.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Right hand round nose roughing tool
b. Left hand round nose roughing tool
c. Square nose roughing tool
d. Square nose finishing tool
e. Gooseneck finishing tool
f. Right hand dovetail roughing tool
g. Left hand dovetail finishing tool
h. Gang tools
i. Carbide tools
j. Negative rake

Provide Demonstration On:

Grinding and attaching tools

Provide Practical Application On:

Grind and attach tools for specific jobs.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, *Machine Trades II*, Work Assignment Sheet #4

Tools and Equipment:

a. Planer
b. Cutting tools
c. *Machinist's Handbook*

CLASSROOM HOURS

8½

EVALUATION (MS-137)

a. Given a shaper, cutting tools and a project blueprint, the student will select a cutting tool, grind the tool to specifications and install in the correct tool holder. 100 percent accuracy is required.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-138 Setting up the planer and calculating speed and feed

PERFORMANCE OBJECTIVE

Set up the planer and calculate cutting and feed speed.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Speed and feed
b. Strokes per minute (SPM) and feet per minute (FPM)
c. Cutting stroke and return stroke
d. Rough and finish cuts
e. Calculating cutting speed and feed for types of metal, amount to be removed, and cutting tool used
f. Table feed

Provide Demonstration On:

Calculating cutting speed and feed speed and setting up the planer for a given job

Provide Practical Application On:

Calculate cutting and feed speeds and set up the planer for a given job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Work Assignment Sheet #6

Tools and Equipment:

a. Planer
b. Selection of tools and holders
c. Stock
d. Machinist's Handbook

CLASSROOM HOURS 6

EVALUATION (MS-138)

a. Given a planer and necessary tools and equipment, the student will calculate speed and feed for a given job and set the machine up, calculations must be within 10% of instructors and set up must conform to Machinist's Handbook.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-139 Performing planing operations

PERFORMANCE OBJECTIVE

Set up the planer and make a rough and a finish cut on a specified job.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Checking the crossrail for perfect alignment
b. Blocking and shimming
c. The planer gage
d. Regulating table travel
e. Squaring the head
f. Operating at maximum feed and speed
g. Beveling work piece before starting operation
h. Taking up back lash

Provide Demonstration On:

Setting up and cutting stock

Provide Practical Application On:

a. Set up planer
b. Select and grind tools
c. Mount stock
d. Make a rough and finish cut

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Work Assignment Sheet #7

Tools and Equipment:

a. Planer
b. Tools and equipment
c. Measuring tools
d. Stock

CLASSROOM HOURS 4½

EVALUATION (MS-139)

a. Given a planer and necessary tools and equipment, the student will set up the machine, grind the necessary cutting tools and cut to given dimensions. Work must be done within tolerances specified by the instructor.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-140 Maintaining and caring for the planer

PERFORMANCE OBJECTIVE

Provide daily lubrication, adjustment and major oil change.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cleaning the planer
b. Lubricating
c. Oil change
d. Adjustments
e. Inspection

Provide Demonstration On:

Daily maintenance and adjustments

Provide Practical Application On:

Clean and care for the planer as it is used.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Kibbe

Student Manuals:

Ohio, Machine Trades II, Work Assignment Sheet #15

Tools and Equipment:

a. Manufacturer's lubrication chart
b. Hand tools and equipment for changing oil and adjusting
c. Brush

CLASSROOM HOURS 2

EVALUATION (MS-140)

a. Given a planer, the student will clean, lubricate and adjust according the manufacturer's specifications.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-141 Identifying types, sizes, construction, specifications, nomenclature and range of work for milling machines

PERFORMANCE OBJECTIVE

Recognize types and sizes of milling machines and what kinds of work they do.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Functions of the milling machine
b. Column and knee type
c. Adjustable spindle type
d. Plain and universal machines
e. Vertical and bed
f. End and face milling
g. Column
h. Knee
i. Table
j. Spindle
k. Overarm
l. Coolants and cutting fluids

Provide Demonstration On:

Identifying parts and components on the machine

Provide Practical Application On:

Identify parts and function of the milling machine.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

A/Vs:

a. Bergwall, Filmstrip #502-1, "Milling Machine Explained"
b. Prentice-Hall, Filmstrip #VD919-1, "Machine Shop: Horizontal Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheets #1, 8

Tools and Equipment:

a. Milling machine
b. Display of work done on a milling machine

CLASSROOM HOURS 8

EVALUATION (MS-141)

a. Given a milling machine with parts marked or tagged, the student will identify each tagged part and describe the function of each. 100 percent accuracy is required.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-142 Identifying milling machine work holding devices and their function

PERFORMANCE OBJECTIVE

Identify and select a work holding device for a specific job.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Milling machine safety
b. Vises
    1. Flanged
    2. Plain
    3. Cam-action
    4. Swivel
    5. Tool makers vise
c. Fixtures
e. Importance of holding work piece securely and accurately

Provide Demonstrations On:

Selecting a work holding device for a given job

Provide Practical Application On:

a. Clean and place vise on bed.
b. Align vise by sight.
c. Fasten vise to bed with clamping bolts.
d. Place dial indicator attachment in mill spindle or magnetic tool holder.
e. Fasten dial indicator to attachment.
f. Indicate the fixed vise jaw.
g. Secure clamp bolts.
h. Recheck with indicator.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Walker
d. Kibbe

A/Vs:

a. Bergwall, Filmstrip #502-2 "Milling Machine Explained"
b. Prentice-Hall, Filmstrip #VD919-2, "Machine Shop: Horizontal Milling Machine"; #VD920-1, "Machine Shop: Vertical Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #4

Tools and Equipment:

a. Milling machine
b. Selection of work holding devices
c. Stock
d. Measuring tools

CLASSROOM HOURS

3

EVALUATION (MS-142)

a. Given a milling machine and work holding devices, the student will identify each device and describe the type of work the device is used with. One hundred percent accuracy is required.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 115.

TASK

MS-143 Identifying, selecting and aligning milling machine attachments

PERFORMANCE OBJECTIVE

Identify, select and install a milling machine attachment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Index head
b. Slotting attachment
c. Rotary table
d. High speed attachment
e. Rack milling attachment
f. Universal milling attachment

Provide Demonstration On:

Selecting and installing the attachment

Provide Practical Application On:

a. Replace draw bar with extended draw bar.
b. Drop quill approximately 3 inches and lock.
c. Insert 90 degree attachment driver in quill and tighten draw bar securely, being careful to align key with keyway.
d. Position indicating surface parallel with table movement.
e. Snug the two housing clamp bolts.
f. Attach magnetic base with dial indicator.

(continued on back page)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Proter
c. Walker
d. Kibbe

A/Vs:

a. Bergwall, Filmstrip #502-3,4,5, "Milling Machine Explained"
b. Prentice-Hall, Filmstrip #VD919-5, "Machine Shop: Horizontal Milling Machine"; #VD920-4 "Machine Shop: Vertical Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #5

Tools and Equipment:

a. Milling machine
b. Selection of attachments
c. Measuring tools

CLASSROOM HOURS

8

EVALUATION (MS-143)

a. Given a milling machine and attachments, the learner must select the correct attachment for a given job, install and align. Attachment must be aligned to within ± 0.001 ".

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 116.

INSTRUCTIONAL ACTIVITIES (continued)

Provides Practical Application On:

g. Indicate the 90 degree milling attachment for parallel alignment.
h. Secure housing clamp bolts.
i. Recheck step for accuracy.

TASK

MS-144 Selecting and setting up milling machine cutters and holders

PERFORMANCE OBJECTIVE

Identify and attach cutting tools and holders.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Milling cutters
   1. Spiral end mill
   2. Two lip end mill
   3. T-slot
   4. Woodruff key seat
   5. Involute spur-gear
   6. Plain
   7. Side
   8. Staggered tooth
   9. Slitting saw
   10. Angular
b. Arbors or holders
   1. End mill arbor
   2. Fly cutter arbor
   3. Standard arbor
   4. Face mill arbor
   5. Shell mill arbor
   6. Collet and adapter
   7. Standard arbor
c. Removing metal from the teeth of a cutter

Provide Demonstration On:

Selecting and installing a cutter and holder

Provide Practical Application On:

Select and install a cutter and holder for a specific job.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Walker
d. Kibbe

A/Vs:

a. Bergwall, Filmstrip #502-2, "Milling Machine Explained"
b. Prentice-Hall, Filmstrip #XF919-2, "Machine Shop: Horizontal Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #6

Tools and Equipment:

a. Milling machine
b. Cutters and holders
c. Measuring tools
d. Machinist's Handbook

CLASSROOM HOURS

10

EVALUATION (MS-144)

a. Given a milling machine and necessary tools and equipment, the student will select a cutter for a given job and install in the correct holder. Selection and installation must conform to Machinist's Handbook.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-145 Calculating cutting speeds and feeds for milling machine work

PERFORMANCE OBJECTIVE

Calculate cutting speeds and feeds.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cutting speed
b. Cutting feed
c. Factors determining speed and feed
d. Tempered cutters
e. Carbide cutters
f. High speed steel cutters
g. Cutting speed formula
h. Rough and finish cuts

Provide Demonstration On:

Determining cutting speed and feed for a given job

Provide Practical Application On:

a. Select and set speed
    1. Identify and classify material to be machined.
    2. Identify cutter to be used.
    3. Determine condition of milling machine.
    4. Determine depth of cut to be made.
    5. Establish material cutting speed.
    6. Determine speed setting for machine by using handbook tables.
    7. Set speed according to operation manual.

(continued on next page)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Walker
d. Kibbe

A/Vs:

Prentice-Hall, Filmstrip #VD919-3, "Machine Shop: Horizontal Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #7

Tools and Equipment:

a. Milling machine
b. Selection of cutters
c. Stock
d. Machinist's Handbook

CLASSROOM HOURS

3

EVALUATION (MS-145)

a. Given a milling machine and work assignment, the student will select the proper cutter and attachment, calculate the speed and feed and install. Selection, calculation and installation must conform to Machinist's Handbook.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 137.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

b. Select and set feed
   1. Repeat steps 1-4 (item a) on previous page
   2. Determine appropriate feed by using handbook tables.
   3. Set feed according to operation manual.

TASK

MS-146 Performing a plain milling operation

PERFORMANCE OBJECTIVE

Set up and square the sides of a rectangle.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Plain milling cutters
    1. Straight tooth
    2. Helical tooth
c. Slab milling
d. Direction cutter teeth revolve
e. Using the dial indicator to square up vise
f. Caution against moving cutter back over finished work
g. Speeds and feeds

Provide Demonstration On:

a. Selecting cutters and holders
b. Setting up machine
c. Squaring up vise
d. Making cuts

Provide Practical Application On:

a. Identify and classify workpiece material.
b. Mount and position vise.
c. Select and mount cutter.
d. Select and set up speed and feed.
e. Mount and align workpiece to cutter.

(continued on next page)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Walker
d. Kibbe

A/Vs:

a. Bergwall, Filmstrip #502-4, "Milling Machine Explained"
b. Prentice-Hall, Filmstrip #VD919-3, "Machine Shop: Horizontal Milling Machine"; #VD920-2, "Machine Shop: Vertical Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #9

Tools and Equipment:

a. Milling machine
b. Plain milling cutters and arbors
c. Dial indicator
d. Vise
e. Workpiece

CLASSROOM HOURS

10

EVALUATION (MS-146)

a. Given a milling machine, a selection of cutters and necessary tools and equipment, the student will square up the sides of a rectangle. Finished measurement must be ± 0.001 " of given specifications.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 115, 116, 139.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Practical Application On:

f. Make first cut.
g. Turn off machine, rotate workpiece to place finished side against fixed vise jaw and secure.
h. Make second cut to depth.
i. Measure for accuracy and place workpiece so that second finished surface (steps g and h) is on the bottom of the vise.
j. Make third cut.
k. Turn off machine, measure for accuracy, and rotate workpiece.
l. Cut remaining side.
m. Measure for squareness and accuracy.

TASK

MS-147 Performing a face milling operation

PERFORMANCE OBJECTIVE

Machine a flat surface using the face milling cutter.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Face milling operation
c. Right-hand and left-hand face milling cutters
d. Speeds
e. Vertical attachment and end mills
f. Mounting the cutter
    1. Stub arbor
    2. Bolted to spindle
g. Speeds and feeds
h. Work alignment

Provide Demonstration On:

a. Setting up machine
b. Selecting and mounting cutter
c. Mounting workpiece
d. Making a cut

Provide Practical Application On:

Set up and mill a flat surface to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Walker
d. Kibbe

A/Vs:

Prentice-Hall, Filmstrip #XF919-3, "Machine Shop: Horizontal Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #10

Tools and Equipment:

a. Milling Machine
b. Face milling cutter and holder
c. Measuring instruments
d. Work holder
e. Workpiece

CLASSROOM HOURS 4

EVALUATION (MS-147)

a. Given a milling machine, a selection of cutters and necessary tools and equipment, the student will perform a face milling operation to a tolerance of ± 0.001" to specifications. Finished work must be smooth without gouges or marks.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-148 Performing a side milling operation

PERFORMANCE OBJECTIVE

Machine a vertical surface with a side milling cutter.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Side milling operation
c. Side milling cutters
d. Speeds and feeds
e. Attachments
f. Holding devices
g. Work alignment

Provide Demonstration On:

a. Setting up machine
b. Selecting and mounting cutter
c. Mounting work piece
d. Making a cut

Provide Practical Application On:

Set up and mill a vertical surface to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

A/Vs:

Prentice-Hall, Filmstrip #VD920-2, "Machine Shop: Vertical Milling Machine

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #11

Tools and Equipment:

a. Milling machine
b. Side milling cutter and attachment
c. Measuring instruments
d. Work holder
e. Workpiece

CLASSROOM HOURS 5

EVALUATION (MS-148)

a. Given a milling machine, a selection of cutters and necessary tools and equipment, the student will perform a side milling operation to a tolerance of ± 0.001" to specifications. Finished work must be smooth without gouges or marks.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-149 Performing a form milling operation

PERFORMANCE OBJECTIVE

Machine an irregularly shaped surface with a form milling cutter.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Form milling operation
c. Form milling cutters
d. Speeds and feeds
e. Attachments
f. Holding devices
g. Work alignment

Provide Demonstration On:

a. Setting up machine
b. Selecting and mounting cutter
c. Mounting workpiece
d. Making a cut

Provide Practical Application On:

a. Secure a well-sharpened cutter of the proper form.
b. Mount the proper size arbor in the spindle. Be sure the taper on the arbor and spindle are clean.
c. Mount the cutter on the arbor. Special attention should be given to keys and keyways of the proper size.
d. Secure the overarm support as near the cutter as possible.

(continued on next page)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #12

Tools and Equipment:

a. Milling machine
b. Form milling cutters and attachments
c. Measuring instruments
d. Work holders
e. Workpiece

CLASSROOM HOURS 10

EVALUATION (MS-149)

a. Given a milling machine, a selection of cutters and necessary tools and equipment, the student will perform a form milling operation to a tolerance of ± 0.001" to specifications. Finished work must be smooth without gouges or marks.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 132.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

e. Secure the work to the machine by any acceptable work-holding method. Be certain the work is square with the machine.
f. Position the work cutter in the desired position.
g. Determine the depth of cut.
h. Set the depth of cut, take the first cut and check the cut.
i. Reset if necessary to proper depth and securely lock the knee. This is done to prevent the table from moving up or down during the cut. The same may be done with the saddle cross slide to prevent transverse movement.
j. Finish machining the work to desired form. The spindle speed form milling should be about the same diameter and type of steel. The feed which is expressed in inches per minute should be less for form milling as the form cutters have coarser teeth. The coarser the teeth the less the feed so that each tooth will not be overworked.

TASK

MS-150 Performing an angular milling operation

PERFORMANCE OBJECTIVE

Machine a workpiece to a specified angle and height.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Angle
c. Angular milling cutters
d. Speeds and feeds
e. Attachments
f. Holding devices
g. Work alignment

Provide Demonstration On:

a. Setting up machine
b. Selecting and mounting cutter
c. Mounting workpiece
d. Making a cut

Provide Practical Application On:

a. Identify and classify workpiece material.
b. Mount and align angle plate.
c. Select and mount end mill cutter
d. Select and set speed, feed, and depth of cut
e. Make cut
f. Check surface and tolerance specifications, making machine adjustments when necessary.
g. Measure and inspect workpiece.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Kibbe

A/Vs:

Prentice-Hall, Filmstrip #VD920-4, "Machine Shop: Vertical Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #13

Tools and Equipment:

a. Milling machine
b. Angular milling cutter and attachment
c. Measuring instruments
d. Work holder
e. Workpiece
f. Machinist's Handbook

CLASSROOM HOURS

4

EVALUATION (MS-150)

a. Given a milling machine, a selection of cutters and necessary tools and equipment, the student will perform an angular milling operation to a tolerance of ± 5 minutes. Finished work must be smooth without gouges or marks.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 125.

TASK

MS-151 Performing an end milling operation

PERFORMANCE OBJECTIVE

Machine all surfaces of a workpiece using an end milling cutter.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. End milling operation
c. End milling cutters
d. Shell end mills
e. Speeds and feeds
f. Attachments
g. Holding devices
h. Work alignment

Provide Demonstration On:

a. Setting up machine
b. Selecting and mounting cutter
c. Mounting workpiece
d. Making a cut

Provide Practical Application On:

a. Identify and classify workpiece material.
b. Mount and align vise.
c. Secure workpiece in holding device.
d. Select and mount end mill cutter.
e. Select and set speed and feed.
f. Align workpiece, touch off, and set depth of cut.
g. Mill to prescribed lines, measure to ensure accuracy, and make necessary adjustments.
h. Mill to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Kibbe

A/Vs:

Bergwall, Filmstrip #502-3, "Milling Machine Explained"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #15

Tools and Equipment:

a. Milling machine
b. End milling cutter and attachment
c. Measuring instruments
d. Work holder
e. Workpiece
f. Machinist's Handbook

CLASSROOM HOURS

3½

EVALUATION (MS-151)

a. Given a milling machine, a selection of cutters and necessary tools and equipment, the student will perform an end milling operation machining all surfaces to a tolerance of ± 0.001 ". Finished work must be smooth without gouges or marks.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 130.

TASK

MS-152 Performing a gang milling operation

PERFORMANCE OBJECTIVE

Perform a gang milling operation using at least 2 cutters mounted on the arbor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Gang milling operation
c. Straddle milling operation
d. Production milling
e. Speeds and feeds
f. Attachments
g. Holding devices
h. Work alignment
i. Power required

Provide Demonstration On:

a. Setting up machine
b. Selecting and mounting cutter
c. Mounting workpiece
d. Making a cut

Provide Practical Application On:

a. Identify and classify workpiece material.
b. Secure vise to machine table.
c. Select, mount, measure and align cutters.
d. Mount workpiece.
e. Select and set speed and feed.
f. Make preliminary cut.
g. Measure, making adjustments as necessary.
h. Cut to specifications and inspect workpiece.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. McCarthy
d. Kibbe

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #14

Tools and Equipment:

a. Milling machine
b. Milling cutters and attachment
c. Measuring instruments
d. Work holder
e. Workpiece
f. Machinist's Handbook

CLASSROOM HOURS

5

EVALUATION (MS-152)

a. Given a milling machine, a selection of cutters and necessary tools and equipment, the student will perform a gang milling operation to an accuracy of ± 0.002 ". Finished work must be smooth without gouges or marks.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 136.

TASK

MS-153 Drilling, boring and reaming with the milling machine

PERFORMANCE OBJECTIVE

Drill a hole and ream or bore to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Accuracy obtained
c. Drilling, boring and reaming horizontally and vertically
d. Speeds and feeds
e. Attachments
f. Holding devices
g. Work alignment
h. Layout work
i. Determining hole sizes

Provide Demonstration On:

a. Setting up machine
b. Selecting and mounting attachments
c. Mounting a workpiece

Provide Practical Application On:

a. Drilling
  1. Mount and align holding device.
  2. Secure part in holding device.
  3. True in over first hole to be drilled.
  4. Set machine speed.
  5. Center-drill workpiece.

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Walker
c. Kibbe

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #16

Tools and Equipment:

Milling machine

CLASSROOM HOURS	12

EVALUATION (MS-153)

a. Given a milling machine and necessary tools and equipment, the student will drill, ream and bore a hole to specifications. Hole must be centered and finished to a tolerance of ± 0.0005.

b. Ohio, Machine Trades II, Instructor Manual.

c. V'TECS, Machine Shop, Task No. 118, 119, 120.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

6. Drill first hole.
7. Use mill graduated dials to step over and drill subsequent holes to specifications.

b. Boring
   1. Lay out hole location.
   2. Secure workpiece to table.
   3. True mill wiggler.
   4. Locate center of hole.
   5. Select and set speeds and feeds as necessary.
   6. Countersink workpiece.
   7. Drill pilot hole.
   8. Drill hole to allow for clearance in boring.
   8. Bore hole to dimensions.

c. Reaming
   1. Identify and classify workpiece material.
   2. Mount and align holding device.
   3. Secure and align workpiece.
   4. Select and set speed and feed (repeating as necessary).
   5. Center-drill workpiece.
   6. Drill workpiece to specifications.
   7. Ream hole to specifications.

TASK

MS-154 Performing sawing, slitting and cutting off operations with the milling machine

PERFORMANCE OBJECTIVE

Saw, slit and cut off metal to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Accuracy required
c. Attachments
d. Speeds and feeds
e. Gang slitting
f. Holding devices
g. Work alignments
h. Determining depth of cut and length of feed

Provide Demonstration On:

a. Setting up machine
b. Selecting and mounting cutters
c. Making a cut

Provide Practical Application On:

a. Identify and classify workpiece material.
b. Mount and align workpiece in holding device.
c. Select and mount cutter.
d. Select and set speed, feed, and depth of cut.
e. Align workpiece to cutter.
f. Perform milling operation to specifications.
g. Measure finished part for accuracy.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Walker
d. Kibbe

A/Vs:

Prentice-Hall, Filmstrip #VD919-5, "Machine Shop: Horizontal Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #17

Tools and Equipment:

a. Milling machine
b. Cutters and attachments
c. Measuring instruments
d. Work holder
e. Workpiece
f. Machinist's Handbook

CLASSROOM HOURS

6

EVALUATION (MS-154)

a. Given a milling machine and necessary tools and equipment, the student will cut off a piece of metal to specifications.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 127.

TASK

MS-155 Performing keyseating and T-slot milling operations

PERFORMANCE OBJECTIVE

Cut a woodruff key seat and a T-slot to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Accuracy required
c. Attachments
d. Speeds and feeds
e. Determining slot and seat sizes
f. Holding devices
g. Work alignment

Provide Demonstration On:

a. Setting up machine
b. Selecting and mounting cutters
c. Making a cut

Provide Practical Application On:

a. Key seating
  1. Mount, secure, and align vise to table.
  2. Select, mount and secure cutter.
  3. Set machine speed.
  4. Set center line of cutter on center line of shaft, close to holding device.
  5. Turn machine on and touch off.
  6. Mill to prescribed depth and length.

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Walker
d. Kibbe

A/Vs:

Bergwall, Filmstrip #502-3, "Milling Machine Explained"

Student Manuals:

Ohio, *Machine Trades II*, Milling Assignment Sheet #18

Tools and Equipment:

a. Milling machine
b. Cutters and attachments
c. Measuring instruments
d. Work holder
e. Work piece
f. *Machinist's Handbook*

CLASSROOM HOURS

10

EVALUATION (MS-155)

a. Given a milling machine and necessary tools and equipment, the student will cut a woodruff key seat and a T-slot to a tolerance of ± 0.005.

b. Ohio, Machine Trades II, Instructor Manual.

c. V'TECS, Machine Shop, Task No. 127.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

b. T-Slotting
    1. Identify and classify workpiece to table.
    2. Secure workpiece to table.
    3. Position slotting attachment over table.
    4. Select and secure cutter to spindle.
    5. Select and adjust stroke length.
    6. Align cutter to workpiece
    7. Set speed.
    8. Slot to specifications.

TASK

MS-156 Performing indexing operations

PERFORMANCE OBJECTIVE

Cut a flute or groove and a helix using the dividing head.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Accuracy required
c. Attachments and cutters
d. Speeds and feeds
e. Determining number of turns of index crank
f. Selecting the index plate
g. Work and vise alignment

Provide Demonstration On:

a. Setting up machine and dividing head
b. Selecting and mounting cutters
c. Making a cut and repositioning the index using the index fingers

Provide Practical Application On:

a. Identify and classify workpiece material.
b. Mount and align dividing head.
c. Select and mount cutter.

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Walker
d. Kibbe

A/Vs:

a. Bergwall, Filmstrip #502-5, "Milling Machine Explained"
b. Prentice-Hall, Filmstrip #VD919-4, "Machine Shop: Horizontal Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheets #19 20, 21

Tools and Equipment:

a. Milling machine, dividing head and accessories
b. Cutters and attachments
c. Measuring instruments
d. Work holder
e. Workpiece
f. Machinist's Handbook

CLASSROOM HOURS 12

EVALUATION (MS-156)

a. Given a milling machine and necessary tools and equipment, the student will cut a flute and a helix gear. All work must be ± 0.001" to specifications.

b. Ohio, Machine Trades II, Instructor Manual.

c. V'TECS, Machine Shop, Task No. 133.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

d. Mount and align holding device and workpiece.
e. Determine number of indexes that workpiece must be rotated.
f. Set up indexing unit of dividing head.
g. Select and set up speed and feed.
h. Touch off, make primary cut, and adjust for depth of cut.
i. Measure for blueprint specifications, making necessary adjustments.
j. Recut if necessary.
k. Rotate indexing unit for each subsequent cut specified.
l. Inspect and measure finished part to blueprint specifications.

TASK

MS-157 Performing circular milling operations

PERFORMANCE OBJECTIVE

Cut a circle segment to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Accuracy required
c. Attachments and rotary table
d. Speeds and feeds
e. Determining the desired ARC
f. Holding devices
g. Work alignment

Provide Demonstration On:

a. Setting up machine and determining desired ARC
b. Selecting and mounting cutters
c. Making a cut

Provide Practical Application On:

Set up machine and cut a circle segment and a circular slot.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

A/Vs:

Bergwall, Filmstrip #502-3, "Milling Machine Explained"

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #22

Tools and Equipment:

a. Milling machine and rotary attachment
b. Cutters and attachments
c. Measuring instruments
d. Work holder
e. Workpiece
f. Machinist's Handbook

CLASSROOM HOURS

6

EVALUATION (MS-157)

a. Given a milling machine and necessary tools and equipment, the student will cut a circle segment and a cylindrical slot to a tolerance of ± 0.001.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 127.

TASK

MS-158 Performing graduating and marking operations

PERFORMANCE OBJECTIVE

Cut witness marks of equal graduation on a flat and a cylindrical surface.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Accuracy required
c. Attachments, scriber tool and arbor, spacers
d. Speeds and feeds
e. Determining graduation degrees
f. Holding devices
g. Work alignment
h. Using the index head and gear train for cylindrical work

Provide Demonstration On:

a. Setting up machine
b. Selecting and mounting cutters
c. Making a cut

Provide Practical Application On:

Set up machine and cut graduation marks on a flat surface and cylindrical surface.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

A/Vs:

Bergwall, Filmstrip #502-5, 6, "Milling Machine Explained"

Student Manuals:

Ohio, *Machine Trades II*, Milling Assignment Sheet #23

Tools and Equipment:

a. Milling machine
b. Cutters and attachments
c. Measuring instruments
d. Work holder
e. Work piece
f. *Machinist's Handbook*

CLASSROOM HOURS 4

EVALUATION (MS-158)

a. Given a milling machine and necessary tools and equipment, the student will cut graduation marks to .001 inches with a tolerance of ± 0.0001.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-159 Performing profiling

PERFORMANCE OBJECTIVE

Cut a sheetmetal template and use for the profiling operation.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Cutting the template
c. Accuracy required
d. Clamping template to work-piece attachments (pantograph)
e. Speeds and feeds
f. Rough and finish cuts holding devices
g. Work alignment
h. Hand and eye coordination

Provide Demonstration On:

a. Setting up machine
b. Cutting template
c. Selecting and mounting cutters
d. Making a cut

Provide Practical Application On:

a. Mount and align holding device.
b. Mount and align pattern-holding device.
c. Mount workpiece and pattern.
d. Select and mount cutter and stylus.

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

Tools and Equipment:

a. Milling machine
b. Cutters and attachments
c. Measuring instruments
d. Work holder
e. Workpiece
f. Machinist's Handbook

CLASSROOM HOURS 8

EVALUATION (MS-159)

a. Given a milling machine and necessary tools and equipment, the student will cut a template to specifications and use the template to profile a workpiece. All work must be to a tolerance of ± 0.005" of profile dimensions.

b. Ohio, Machine Trades II, Instructor Manual.

c. V'TECS, Machine Shop, Task No. 123.

INSTRUCTIONAL ACTIVITIES

Provide Practical Applications On:

e. Select and set speed and feed.
f. Duplicate the profile.
g. Measure to determine accuracy.
h. Make adjustments as necessary.

TASK

MS-160 Maintaining and caring for the milling machine

PERFORMANCE OBJECTIVE

Provide daily lubrication, adjustment and major oil change.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cleaning the machine
b. Lubricating
c. Adjustments
d. Inspection
e. Removing nicks and burrs from machined surfaces

Provide Demonstration On:

Daily maintenance and adjustments

Provide Practical Application On:

Clean and care for the milling machine as it is used.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Porter
c. Kibbe

Student Manuals:

Ohio, Machine Trades II, Milling Assignment Sheet #2

Tools and Equipment:

a. Manufacturer's lubrication chart
b. Hand tools and equipment for lubrication and adjusting machine
c. Brush

CLASSROOM HOURS

3

EVALUATION (MS-160)

a. Given a milling machine, the student will clean, lubricate and adjust it according to manufacturer's specifications.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-161 Identifying types of gears and their function

PERFORMANCE OBJECTIVE

Select and identify designs and types of gears.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Internal gears
b. Spur gears
c. Worm gears
d. Rack and pinion gears
e. Hypoid gears
f. Bevel gears
g. Herringbone gears
h. Helical gears
i. Planetary sets
j. Gear ratios
k. Materials used in manufacture

Provide Demonstration On:

Selecting, identifying and describing the functions of gears

Provide Practical Application On:

Locate and identify various gears and gear sets on display or used in machinery.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

Student Manuals:

Ohio, Machine Trades II, Gear Assignment Sheet #1

Tools and Equipment:

a. Selection of gears
b. Gearing arrangements

CLASSROOM HOURS

10

EVALUATION (MS-161)

a. Given a selection of gears and gear arrangements, the student will select and identify each gear. The student will describe at least three uses of each gear. This must be done with 80% accuracy.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-162 Identifying gear tooth elements and their symbols

PERFORMANCE OBJECTIVE

Identify gear symbols used in formulas.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Face
b. Flank
c. Pitch circle
d. Root circle
e. Addendum
f. Dedendum
g. Circular pitch
h. Working depth
i. Clearances
j. Chordal Thickness
k. Pitch and outside diameters
l. Pressure angle
m. Tooth profile

Provide Demonstration On:

Naming the gear tooth elements

Provide Practical Application On:

Name the gear tooth elements on different gears.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

Student Manuals:

Ohio, Machine Trades II, Gear Assignment Sheet #4

Tools and Equipment:

a. Gears
b. Gear drawings
c. Machinist's Handbook

CLASSROOM HOURS 6

EVALUATION (MS-162)

a. Given a gear drawing, the student will label each part using correct symbols. 100 percent accuracy is required.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-163 Calculating the pitch, diameters, working depth and clearances for machining gears

PERFORMANCE OBJECTIVE

Make all necessary calculations to machine a spur gear to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Formulas
  1. Pitch diameter
  2. Diametral pitch
  3. Addendum
  4. Dedendum
  5. Outside diameter
  6. Number of teeth
  7. Tooth thickness
  8. Whole depth
  9. Clearance
  10. Center distance
  11. Working depth
  12. Chordal tooth thickness
  13. Chordal addendum
  14. Center distance

b. Pressure angles

Provide Demonstration On:

Determining the dimensions for a given gear with diametral pitch and pressure angle known

Provide Practical Application On:

Determine the dimensions for a given gear with diametral pitch and pressure angle known.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

Student Manuals:

Ohio, Machine Trades II, Gear Assignment Sheets #5, 6, 7, 8

Tools and Equipment:

a. Spur gears
b. Drawings
c. Machinist's Handbook

CLASSROOM HOURS 8

EVALUATION (MS-163)

a. Given a spur gear drawing, the student will calculate all dimensions to a tolerance of ± 0.001.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-164 Milling a spur gear

PERFORMANCE OBJECTIVE

Set up machine and mill a gear blank to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Review of attachments and index head, cutting feeds, speeds and job setups
b. Gear blanks
c. Review of dimension calculations
d. Selection of gear tooth cutters
e. Making trial cuts

Provide Demonstration On:

Setting up machine and making a trial cut on a gear blank

Provide Practical Application On:

a. Press gear blank on mandrel.
b. Mount dividing head and tailstock on mill.
c. Secure mandrel to indexing head.
d. Select and secure cutter to mill.
e. Determine and set indexing head to correct divisions.
f. Center gear blank to cutter.
g. Select and set speed, feed, and depth of cut.
h. Cut gear to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

A/Vs:

Prentice-Hall, Filmstrip #XF919-4, "Machine Shop: Horizontal Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Gear Assignment Sheet #3

Tools and Equipment:

a. Milling machine
b. Attachments
c. Gear drawings
d. Finished gears
e. Measuring tools
f. Machinist's Handbook

CLASSROOM HOURS 6½

EVALUATION (MS-164)

a. Given a milling machine and necessary tools and equipment, the student will mill a spur gear to specifications.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 128.

TASK

MS-165 Milling a gear rack

PERFORMANCE OBJECTIVE

Set up machine and mill a gear rack to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Review of attachments and index head, cutting feeds, speeds and job setups
b. Rack milling attachment
c. Review of dimension calculations for circular pitch and whole depth
d. Selection of gear tooth cutters
e. Making trial cuts

Provide Demonstration On:

Setting up machine and making a trial cut

Provide Practical Application On:

a. Mount dividing head and tailstock on mill.
b. Secure mandrel to indexing head.
c. Select and secure cutter to mill.
d. Determine and set indexing head to correct division.
e. Center gear blank to cutter.
f. Select and set speed, feed, and depth of cut.
g. Cut gear to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

Student Manuals:

Ohio, Machine Trades II, Gear Assignment Sheet #9

Tools and Equipment:

a. Milling machine
b. Attachments
c. Gear drawings
d. Finished gears
e. Measuring tools
f. Machinist's Handbook

CLASSROOM HOURS

10

EVALUATION (MS-165)

a. Given a milling machine and necessary tools and equipment, the student will mill a gear rack to specifications.

b. Ohio, Machine Trades II, Instructor Manual.

c. V'TECS, Machine Shop, Task No. 128.

TASK

MS-166 Milling a stub gear

PERFORMANCE OBJECTIVE

Set up machine and mill a stub gear blank to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Review of attachments and index head, cutting feeds, speeds and job setups
b. Gear blanks and stub gears
c. Review of dimension calculations and pressure angles
d. Selection of gear tooth cutters
e. Making trial cuts

Provide Demonstration On:

Setting up machine and making a trial cut on a gear blank

Provide Practical Application On:

a. Press gear blank on mandrel.
b. Mount dividing head and tailstock on mill.
c. Secure mandrel to indexing head.
d. Select and secure cutter to mill.
e. Determine and set indexing head to correct division.
f. Center gear blank to cutter.
g. Select and set speed, feed, and depth of cut.
h. Cut gear to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

A/Vs:

a. Bergwall, Filmstrip #502-6, "Milling Machine Explained"
b. Prentice-Hall, Filmstrip #VD919-4, "Machine Shop: Horizontal Milling Machine"

Student Manuals:

Ohio, Machine Trades II, Gear Assignment Sheet #10

Tools and Equipment:

a. Milling machine
b. Attachments
c. Gear drawings
d. Finished gears
e. Measuring tools
f. Machinist's Handbook

CLASSROOM HOURS

8

EVALUATION (MS-166)

a. Given a milling machine and necessary tools and equipment, the student will mill a stub gear to specifications.

b. Ohio, Machine Trades II, Instructor Manual.

c. V'TECS, Machine Shop, Task No. 128.

TASK

MS-167 Milling a bevel gear

PERFORMANCE OBJECTIVE

Set up machine and mill a bevel gear blank to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Review of attachments and index head, cutting feeds, speeds and job setups
b. Parts of the bevel gear
c. Review of dimension calculations including face angle and tangent of dedendum
d. Selection of gear tooth cutters
e. Making trial cuts
f. Trimming teeth by offsetting dividing head

Provide Demonstration On:

Setting up machine and making a trial cut on a gear blank

Provide Practical Application On:

a. Press gear blank on mandrel.
b. Mount dividing head and tailstock on mill.
c. Secure mandrel to indexing head.
d. Select and secure cutter mill.
e. Determine and set indexing head to correct division.
f. Center gear blank to cutter.
g. Select and set speed, feed, and depth of cut.
h. Cut gear to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

A/Vs:

Bergwall, filmstrip #502-6 "Milling Machine Explained"

Student Manuals:

Ohio, Machine Trades II, Gear Assignment Sheets #11, 12, 13

Tools and Equipment:

a. Milling machine
b. Attachments
c. Gear drawings
d. Finished gears
e. Measuring tools
f. Machinist's Handbook

CLASSROOM HOURS

9

EVALUATION (MS-167)

a. Given a milling machine and necessary tools and equipment, the student will mill a bevel gear to specifications.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 128.

TASK

MS-168 Machining a worm gear on the engine lathe

PERFORMANCE OBJECTIVE

Set up engine lathe and turn a worm gear to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Worm gear part names
b. Comparison of worm to Acme thread
c. Review of dimension calculations
d. Selection of gear tooth cutting tool and grinding to shape
e. Making trial cuts

Provide Demonstration On:

Setting up machine and making a trial cut on a gear blank

Provide Practical Application On:

Cut a worm gear on the engine lathe.

INSTRUCTIONAL MATERIALS

Textbooks:

Burghardt, Part II

Student Manuals:

Ohio, Machine Trades II, Gear Assignment Sheets #14, 15, 16

Tools and Equipment:

a. Engine lathe
b. Attachments and cutting tools
c. Gear drawings
d. Finished gears
e. Measuring tools
f. Machinist's Handbook

CLASSROOM HOURS

12

EVALUATION (MS-168)

a. Given an engine lathe and necessary tools and equipment, the student will cut a spur gear to specifications.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-169 Identifying grinders, grinding wheels and attachments

PERFORMANCE OBJECTIVE

Identify and match grinders and grinding wheels with work to be performed.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety while using the grinder
b. Grinding principles and practices
c. Grinding wheels
    1. Component elements
    2. Types and sizes
    3. Selection
    4. Handling, storage and inspection
    5. Truing and dressing
d. Speeds and feeds
e. RPM and grinding wheels
f. Coolants and cutting compound
g. Attachments
h. Cylindrical, internal, surface and face grinding
i. Infeed or plunge cut grinding

Provide Demonstration On:

Safety while using grinder

Provide Practical Application On:

Identify grinders and abrasives for different jobs.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

A/Vs:

Bergwall, Filmstrip #504-1, "The Grinding Machine"

Student Manuals:

Ohio, Machine Trades II, Grinding Assignment Sheets #1-12

Tools and Equipment:

a. Grinders
b. Wheels
c. Abrasives
d. Safety equipment

CLASSROOM HOURS

10

EVALUATION (MS-169)

a. Given a selection of grinders and work to be done, the student will match the grinder and abrasive to a specific job. This must be done with one hundred percent accuracy.

b. V-TECS, Machine Shop, Task No. 70, 73, 75.

c. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-170 Using the bench grinder

PERFORMANCE OBJECTIVE

Grind and sharpen tool bits, boring tools, and drills.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Types and sizes
c. Grinding wheels
d. Wire brush wheel
e. Buffing wheel
f. Dressing and truing wheel
g. Spark tests for metal
h. Tool rests and face guards
i. Caution against grinding soft metals (aluminum, brass, etc.)

Provide Demonstration On:

Sharpening and grinding a planer tool and drill bit

Provide Practical Application On:

Grind drill bits, chisels, planer tools, etc.

INSTRUCTIONAL MATERIALS

Textbooks:

Walker

Student Manuals:

Ohio, *Machine Trades II*, Bench Grinder Assignment Sheets #1-4

Tools and Equipment:

a. Bench or pedestal grinder
b. Safety equipment
c. Items to be sharpened
d. Work blue print

CLASSROOM HOURS

6

EVALUATION (MS-170)

a. Given a bench grinder and necessary equipment, the student will grind or sharpen a drill bit, cold chisel, planer tool and boring tool to specifications.

b. V'TECS, Machine Shop, Task No. 72, 74, 75, 81.

c. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-171 Using the surface grinder

PERFORMANCE OBJECTIVE

Perform plain, face, flute, form and step grinding operations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Types and sizes
c. Attachments and work holding devices
d. Wheels - selection, speeds and feeds, truing and dressing
e. Principal of plain grinding
f. Principles of face grinding
g. Groove and flute grinding
h. Profile or form grinding
i. Step grinding

Provide Demonstration On:

Setting up machine and preparing grinding wheel for plain, face, flute, form and step grinding

Provide Practical Application On:

Use the surface grinder for plain, face, flute, form and step grinding.

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

A/Vs:

Bergwall, Filmstrip #504-2,3 "The Grinding Machine"

Student Manuals:

Ohio, Machine Trades II, Surface Grinder Assignment Sheet #1-10

Tools and Equipment:

a. Surface grinder
b. Safety equipment
c. Blueprints and work stock

CLASSROOM HOURS

10

EVALUATION (MS-171)

a. Given a surface grinder and necessary tools and equipment, the student will perform plain, face, flute, form and step grinding operations. All work must be to blueprint specifications ± 0.0001".

b. V-TECS, Machine Shop, Task No. 70, 72, 74, 75, 78.

c. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-172 Using the cylindrical grinder

PERFORMANCE OBJECTIVE

Perform plain, taper, angular, shoulder, internal, form and face grinding operations.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types, sizes and nomenclature
b. Safety
c. Care and maintenance
d. Wheels - truing and dressing, speeds and feeds
e. Work holding devices
f. Plain grinding
g. Taper and angular grinding
h. Shoulder grinding
i. Internal grinding
j. Form grinding
k. Face grinding
l. Coolants and cutting compounds

Provide Demonstration On:

Setting up machine and performing all grinding operations listed in objective

Provide Practical Application On:

Use the cylindrical grinder for plain, taper, angular, shoulder, internal, form and face grinding operations as per specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

Student Manuals:

Ohio, Machine Trades II, Cylindrical Grinder Assignment Sheet #1-13

Tools and Equipment:

a. Cylindrical grinder
b. Safety equipment
c. Blueprints and work stock

CLASSROOM HOURS 28

EVALUATION (MS-172)

a. Given a cylindrical grinder and necessary tools and equipment, the student will perform plain, taper, angular, shoulder, internal, form and face grinding operations. All work must be to blueprint specifications ± 0.0001".

b. V-TECS, Machine Shop, Task No. 70, 72, 74, 75, 82.

c. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-173 Using the tool and cutter grinder

PERFORMANCE OBJECTIVE

Sharpen and regrind tools used in the machine shop.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Specifications and range of work
b. Safe practices and work precautions
c. Wheels - truing and dressing, speeds and feeds
d. Cylindrical milling cutters
e. Clearance grinding
f. Radial teeth, form cutters, hobs, and end mills
g. Reamers
h. Attachments and accessories

Provide Demonstration On:

Grinding a milling cutter and a reamer to correct specifications

Provide Practical Application On:

Sharpen, grind and reshape machine shop tools.

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

Student Manuals:

Ohio, Machine Trades II, Tool and Cutter Grinder Assignment Sheets #1-8

Tools and Equipment:

a. Grinder
b. Safety equipment
c. Machine shop tools
d. Machinist's Handbook

CLASSROOM HOURS

20

EVALUATION (MS-173)

a. Given a tool and cutter grinder, machine shop tools and necessary material, the student will sharpen and grind tools to specifications required by job.

b. V-TECS, Machine Shop, Task No. 72, 74, 75, 79, 80.

c. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-174 Using the centerless grinder

PERFORMANCE OBJECTIVE

Grind work to specifications on the centerless grinder.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Nomenclature and range of work
c. Attachments
d. Work holding and clamping devices
e. Wheel speeds and grinding feeds
f. Through-feed method
g. In-feed and end-feed method of grinding

Provide Demonstration On:

Grinding a workpiece

Provide Practical Application On:

Grind a workpiece to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

Burghardt, Part II

Student Manuals:

Ohio, Machine Trades II, Centerless Grinder Assignment Sheets #1-7

Tools and Equipment:

a. Centerless grinder
b. Safety equipment
c. Workpiece
d. Measuring instruments

CLASSROOM HOURS

15

EVALUATION (MS-174)

a. Given a centerless grinder, attachments and workpiece, the student will grind the workpiece to blueprint specifications.

b. V-TECS, Machine Shop, Task No. 74, 75.

c. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-175 Performing honing and lapping operations

PERFORMANCE OBJECTIVE

Hone and lap a bushed hole.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Principles of honing
b. Compounds and polishes
c. Internal, external, rotary, and hand lapping
d. Polishing and buffing
e. Superfinishing

Provide Demonstration On:

Honing a bushing to size

Provide Practical Application On:

Hone and lap a bushed hole to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

Porter

Student Manuals:

Ohio, Machine Trades II, Honing and Lapping Assignment Sheets #1-5

Tools and Equipment:

a. Honing and lapping tools
b. Compounds and abrasives
c. Measuring tools

CLASSROOM HOURS

3½

EVALUATION (MS-175)

a. Given necessary tools and equipment, the student will hone and lap a bushed hole to specifications.

b. V-TECS, Machine Shop, Task No. 32, 76.

c. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-176 Identifying metal manufacturing processes

PERFORMANCE OBJECTIVE

Identify metal manufacturing processes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Methods of casting
   1. Sand
   2. Centrifugal
   3. Permanent-mold
   4. Die
b. Permanent-mold casting
c. Centrifugal casting
   1. Application
   2. Procedure
d. Die casting
   1. Hot chamber
   2. Cold chamber
e. Die forging
f. Extrusion
   1. Procedure
   2. Advantages
g. Cold forging steel
   1. Upsetting or heading
   2. Header
   3. Applications
h. Processing metal powders
   1. Electroforming
   2. Powder metallurgy
   3. Metal powder products
i. Stretching, shearing, bending
j. Wire drawing
   1. Material used
   2. Pickling
   3. Sulling

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

A/Vs:

Bergwall, filmstrip #506, "Foundry Work"

Tools and Equipment:

Display of various metals after treatment

CLASSROOM HOURS 30

EVALUATION (MS-176)

Given a specified metal manufacturing process, the student will identify the process, describe the steps in the process and identify the purpose of the process in terms of products.

TASK

MS-177 Identifying the physical structure of metals

PERFORMANCE OBJECTIVE

Define and identify the physical structure of metals.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition of a metal
    1. Lustrous appearance
    2. Conductivity
    3. Number of metals in existence
b. Metallurgy
    1. Ores
    2. Chemical metallurgy
    3. Physical metallurgy
c. Properties of metals
    1. Strength
    2. Malleability
    3. Ductility
    4. Toughness
    5. Elasticity
    6. Ferromagnetic
    7. Thermocouple
d. Metal point of metals
    1. Definition
    2. Latent heat of fusion
e. Arrangement of atoms in metals
    1. Space lattice of geometric crystal structure
    2. Hexagonal close packed space lattice
f. Crystal formation
g. Composition of alloys
h. Nonferrous alloys
i. Cadmium
j. Cobalt
k. How metals are cast
l. Metal working
m. How metals are joined

INSTRUCTIONAL MATERIALS

Textbooks:

a. Burghardt, Part II
b. Kibbe

Student Manuals:

Ohio, *Machine Trades II*, Metallurgy Assignment Sheet #1

Tools and Equipment:

a. Different types of metals
b. Metal ores

CLASSROOM HOURS

20

EVALUATION (MS-177).

a. Given a metal, the student will correctly identify its physical structure in terms of appearance, conductivity, malleability and melting point. This must be done with one hundred percent accuracy.

b. Ohio, Machine Trades II, Instructor Manual.

TASK

MS-178 Identifying properties of metals

PERFORMANCE OBJECTIVE

Identify properties of metals.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Mechanical properties
    1. Hardness
    2. Ductility
    3. Machinability
    4. Tensile strength
b. Stress
c. Kinds of stress
    1. Tension
    2. Compression
    3. Shear
d. Elasticity
    1. Elastic limit
    2. Ultimate breaking strength
e. Strain
f. Metal fatigue

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Provide Demonstration On:

Figuring tensile strength

Provide Practical Application On:

Figure tensile strength of selected metals.

INSTRUCTIONAL MATERIALS

Textbooks:

Burghardt, Part II

Student Manuals:

Ohio, Machine Trades II, Metallurgy Assignment Sheet #2

Tools and Equipment:

a. Tensil strength tester
b. Brinnel hardness tester
c. Shear strength tester

CLASSROOM HOURS

22

EVALUATION (MS-178)

Given a metal, the student will correctly identify its basic properties and figure tensile strength for a specified area and force. This must be done with one hundred percent accuracy.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

g. Causes of failure
  1. Elastic breakdown
  2. Creep failures
h. Useable strength of metal
i. Heat and temperature
  1. Friction
  2. Motion of molecules
  3. Transfer of heat
  4. Heat and cold
j. Expansion of metals
k. Density
l. Specific gravity

TASK

MS-179 Identifying methods of heat treatment

PERFORMANCE OBJECTIVE

Identify methods used to heat treat metals.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Metallurgy and heat treatment
b. Principles of heat treating
c. Equilibrium diagrams
d. Transformation of temperatures
e. Iron-carbon phase diagram
    1. Liquidous line
    2. Solidous line
    3. Eutectic point
    4. Austenite
    5. Delta ferrite
    6. Alpha ferrite
    7. Eutectoid
    8. Pearlite
f. Effects of heating, holding, cooling
g. Isothermal transformation
    1. S-curve or TTT diagram
    2. Pearlite
    3. Bainite
    4. Martensite
h. Heat treating ferrous metals
    1. Hardening
    2. Tempering
    3. Annealing
    4. Normalizing
    5. Spheroidizing
    6. Casehardening

INSTRUCTIONAL MATERIALS

Textbooks:

Burghardt, Part II

Student Manuals:

Ohio, Machine Trades II, Heat Treating Assignment Sheets #1-11

Tools and Equipment:

Various gears, shafts, etc. that have been heat treated

CLASSROOM HOURS

10

EVALUATION (MS-179)

a. Given a specified heat treatment process for metals, the student will identify and describe the process in terms of the properties of the metal.

b. Ohio, Machine Trades II, Instructor Manual.

c. V-TECS, Machine Shop, Task No. 30.

TASK

MS-180 Identifying iron manufacturing processes

PERFORMANCE OBJECTIVE

Identify processes used to produce iron.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Iron ore
b. Making pig iron
    1. Pigs
    2. Pig molds
    3. Smelting
    4. Reduction
    5. Charging the blast furnace
c. Making cast iron
    1. Categories of iron-carbon alloys
    2. Elements in cast iron
    3. Advantages of cast iron
    4. Cupola
    5. Cementite
d. Gray cast iron
    1. Characteristics
    2. Applications
e. White cast iron
    1. Characteristics
    2. Applications
f. Malleable cast iron
    1. Characteristics
    2. Applications
g. Ductile cast iron
    1. Characteristics
    2. Applications
h. Producing steel from iron
    1. Open-hearth process
    2. The Bessemer process
    3. Basic oxygen process
    4. Electric furnace process

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

Burghardt, Part II

Student Manuals:

Ohio, Machine Trades II, Metallurgy Assignment Sheets #3, 4

Tools and Equipment:

a. Examples of iron
b. Milling machine and attachments
c. Machinist's Handbook

CLASSROOM HOURS 12

EVALUATION (MS-180)

a. Given specifications for a type of iron and steel, the student will identify and describe the processes used to produce the iron and steel. The student will machine an iron casting to specifications.

b. Ohio, Machine Trades II, Instructor Manual.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

Machine an iron casting.

TASK

MS-181 Identifying processes used to produce steel

PERFORMANCE OBJECTIVE

Identify processes used to produce steel.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Carbon steels
   1. Points
   2. Low carbon steel
   3. Medium carbon steel
   4. High carbon steel
b. Rolling steel
   1. Ingots
   2. Blooms, billets on slabs
c. Steel forms
   1. Plate
   2. Sheet
   3. Strip
   4. Bars
   5. Hot-rolled
   6. Cold-drawn
   7. Cast

(Continued on back)

Provide Demonstration On:

Identifying steel codes

Provide Practical Application On:

a. Identify the type of steel given and its code.
b. Machine the steel to specifications.

INSTRUCTIONAL MATERIALS

Textbooks:

Burghardt, Part II

Student Manuals:

Ohio, Machine Trades II, Metallurgy Assignment Sheets #6-13

Tools and Equipment:

a. Machinist's Handbook
b. Examples of steels

CLASSROOM HOURS 16

EVALUATION (MS-181)

Given a piece of steel which is coded, the student will identify the code, describe the process used to produce the steel and identify the application of the steel according to instructor's specifications. The student will machine a steel workpiece to specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

d. Hot-rolled steel sheet
    1. Commercial quality (CQ)
    2. Drawing quality (DQ)
    3. Physical quality (PQ)
e. Cold-rolled carbon steel strips
f. Hot-rolled carbon steel strips
h. Carbon steel plates
i. Carbon steel bars
j. Structural steel
k. Constructional grade and tool steels
l. Stainless steel
    1. Austenitic
    2. Ferritic
    3. Martensitic
m. Alloy steels
n. Steel classification
    1. SAE
    2. AISI
o. Steel color codes

TASK

MS-182 Identifying processes used to produce copper, brass and bronze alloys

PERFORMANCE OBJECTIVE

Identify processes used to produce copper, brass and bronze alloys.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Producing copper
    1. Ores
    2. Separating ore
    3. Blister copper
    4. Anodes
    5. Cathodes
b. Copper alloys
    1. Silver
    2. Boron
    3. Lithium
c. Machinability ratings
    1. Adding lead
    2. Naval brass
    3. Red brass
d. Electrical conductivity
e. Corrosion resistance
f. Annealing copper
g. Brass
    1. Yellow (cartridge)
    2. Muntz metal
    3. Admiralty brass
    4. Bronze
h. Phosphor bronze alloys
i. Nickel silver
j. Aluminum bronze
k. Other bronzes
    1. Manganese
    2. Silicon
    3. Bull bronze
    4. Nickel bronze
l. Berryllium Copper
m. Cupro-nickel
n. Copper-alloy casting

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

Burghardt, Part II

Student Manuals:

Ohio, Machine Trades II,
Metallurgy Assignment Sheet #14

Tools and Equipment:

a. Examples of copper and alloys
b. Machinist's Handbook

CLASSROOM HOURS 18

EVALUATION (MS-182)

a. Given specifications for copper and its alloys, the student will identify the type of copper or alloy and describe the process used to produce the metal. The student will machine and hone a bronze bushing to specifications.

b. Ohio, Machine Trades II, Instructor Manual.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

Machining and honing a bronze bushing.

TASK

MS-183 Identifying processes used to produce aluminum

PERFORMANCE OBJECTIVE

Identify processes used to produce aluminum.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Properties of aluminum
    1. Low density
    2. High strength
    3. Electrical conductor (EC) grade
    4. Easy to fabricate
    5. Non-magnetic and non-sparking
b. Production of aluminum
c. Aluminum based alloys
    1. Wrought grades
    2. Casting grades
d. Wrought aluminum grades
    1. Aluminum association designation system
    2. Temper designation
e. Aluminum casting grades
    1. Aluminum association system
    2. Codes for heat-treatable casting alloys
f. Alloying elements
    1. Copper
    2. Silicon
    3. Magnesium
    4. Non-impurities
    5. Zinc, nickel and tin
g. Forming processes
    1. Forging
    2. Powder metallurgy
    3. Cladding
h. Anodizing
    1. Purpose
    2. Industrial applications

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

Burghardt, Part II

Student Manuals:

Ohio, Machine Trades II, Metallurgy Assignment Sheet #15

Tools and Equipment:

a. Examples of aluminum
b. Machinist's Handbook

CLASSROOM HOURS 22

EVALUATION (MS-183)

a. Given a section of aluminum, the student will identify the type and describe the process used to produce it. Using this section of aluminum, the student will machine and grind to specifications.

b. Ohio, Machine Trades II, Instructor Manual.

INSTRUCTIONAL ACTIVITIES

Provide Demonstration On:

Machining and grinding aluminum

Provide Practical Application On:

Machine and grind aluminum.

TASK

MS-184 Identifying processes for the production of magnesium and titanium

PERFORMANCE OBJECTIVE

Identify the process for the production of magnesium and titanium.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Production of magnesium
   1. Magnesium fluoride
   2. Magnesite
   3. Dolomite
   4. Carnallite
b. Extraction of magnesium
   1. Electrolytic method
   2. Carbothermic method
c. Alloying, melting and refining magnesium
d. Alloying magnesium
e. Magnesium alloy designations
f. Magnesium casting alloys
   1. Magnesium-aluminum-maganese (AM)
   2. Magnesium-aluminum-zinc (AZ)
   3. Magnesium-rare earth-zirconium (EK, EZ and ZE)
   4. Magnesium-zinc-zirconium (ZK)
   5. Magnesium-thorium-zirconium (HK, HZ, and ZH)
g. Magnesium wrought alloys
h. Extrusion
i. Rolling
j. Forming
k. Machining
l. Magnesium fires and safety

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

Kibbe

Student Manuals:

Ohio, Machine Trades II, Metallurgy Assignment Sheet #16

CLASSROOM HOURS 20

EVALUATION (MS-184)

a. Given a specification for magnesium, titanium or an alloy, the student will identify the metal, describe the process used to refine it and identify procedures used to join the metal. The completed task must meet the instructor's specifications.

b. Ohio, Machine Trades II, Instructor Manual.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

m. Joining magnesium
    1. Welds, rivets, bolts, or screws
    2. TIG welding and MIG welding

n. Titanium
    1. Processing
    2. Commerically pure titanium
    3. Uses of titanium

SECTION V-a

PROJECTS

SHOP PROJECTS/DUTY AREAS
CROSS REFERENCE MATRIX

A set of student manuals titled Machine Shop Projects is available from the Georgia Department of Education, Division of Vocational Education. The manuals contain 104 projects with drawings, tool lists and step-by-step procedures.

The matrix on the following pages cross-references this Curriculum Guide's duty areas with each project. The projects are listed in the left hand column and the duty areas are listed at the top of the page in the vertical columns. Tasks for each duty area are contained in the Task Listing in Section III of this curriculum guide. An (X) in a duty area column indicates that all tasks listed in the Task Listing within that duty area must be mastered before the corresponding project can be started by the student. Use of the Competency Checklist in Section VII can provide an accurate record of completed tasks.

SHOP PROJECTS/DUTY AREA CROSS REFERENCE MATRIX

GEORGIA MACHINE SHOP PROJECTS / CURRICULUM GUIDE DUTY AREAS	A. Bench Work	B. Drilling Machine Work	C. Engine Lathe Work	D. Turret Lathe Work	E. Power Saw Work	F. Shaper Work	G. Planer Work	H. Milling Machine Work	I. Gears and Gearing	J. Grinder Work	K. Metallurgy
1. Center gage	X										
2. Drill point gage	X										
3. Anchor bolt	X										
4. Mallet	X	X									
5. Stud block	X	X			X						
6. Studs	X										
7. Test Block I	X	X									
8. T-slot cleaner	X				X						
9. Dial indicator stand	X	X			X						
10. Tap wrench	X	X			X						
11. Pipe flange assembly	X	X	X		X						
12. C-clamp	X	X	X		X						
13. Block and tackle	X		X		X						
14. Steel beam trammels	X	X	X		X						
15. Display projects	X	X			X						
16. Jack Stand	X	X	X		X						
17. Gear puller	X	X	X		X						
18. Tool post base	X	X			X						

SHOP PROJECTS/DUTY AREA CROSS REFERENCE MATRIX

CURRICULUM GUIDE DUTY AREAS GEORGIA MACHINE SHOP PROJECTS	A. Bench Work	B. Drilling Machine Work	C. Engine Lathe Work	D. Turret Lathe Work	E. Power Saw Work	F. Shaper Work	G. Planer Work	H. Milling Machine Work	I. Gears and Gearing	J. Grinder Work	K. Metallurgy
19. Right hand tool (general purpose)	X		X							X	
20. Left hand tool (general purpose)	X		X							X	
21. Left hand tool (roughing)	X		X							X	
22. Right hand tool (roughing)	X		X							X	
23. Left hand tool (turning or finishing)	X		X							X	
24. Right hand tool (turning and finishing)	X		X							X	
25. Necking tool	X		X							X	
26. Left hand tool (facing)	X		X							X	
27. Right hand tool (facing)	X		X							X	
28. V-threading tool	X		X							X	
29. V-threading tool (off-set)	X		X							X	
30. Acme threading tool	X		X							X	
31. Micrometer test block	X		X							X	
32. Flaring tool	X	X	X		X						
33. 1/4" pin punch	X		X								
34. 3/16" pin punch	X		X								
35. 1/8" pin punch	X		X								
36. Center punch	X		X								

SHOP PROJECTS/DUTY AREA CROSS REFERENCE MATRIX

CURRICULUM GUIDE DUTY AREAS GEORGIA MACHINE SHOP PROJECTS	A. Bench Work	B. Drilling Machine Work	C. Engine Lathe Work	D. Turret Lathe Work	E. Power Saw Work	F. Shaper Work	G. Planer Work	H. Milling Machine Work	I. Gears and Gearing	J. Grinder Work	K. Metallurgy
37. Prick punch	X		X								
38. Nail set	X		X								
39. Scriber	X		X								
40. Dead center			X								
41. Plumb bob	X	X	X								
42. Dumbell set	X	X	X								
43. Taper plug gage	X		X								
44. Rocker dish	X		X								
45. Rocker	X		X								
46. Tool post body	X		X					X			
47. Circle cutter	X	X	X					X			
48. Saw jig (fly cutter)	X	X	X								
49. Tap wrench II	X	X	X		X	X					
50. Fly cutter	X		X		X			X			
51. Tooth pick holder	X			X						X	
52. Pipe center	X	X	X					X			
53. Taper ring gage	X		X								
54. Set up bolt 1/2" x 4"	X		X								

SHOP PROJECTS/DUTY AREA CROSS REFERENCE MATRIX

GEORGIA MACHINE SHOP PROJECTS / CURRICULUM GUIDE DUTY AREAS	A. Bench Work	B. Drilling Machine Work	C. Engine Lathe Work	D. Turret Lathe Work	E. Power Saw Work	F. Shaper Work	G. Planer Work	H. Milling Machine Work	I. Gears and Gearing	J. Grinder Work	K. Metallurgy
55. Set up bolt 1/2" x 6"	X		X								
56. Set up bolt 1/2" x 8"	X		X								
57. Set up bolt 3/8" x 4"	X		X								
58. Set up bolt 3/8" x 6"	X		X								
59. Drill reducer	X	X	X								
60. Tap drill extension (1/4" - 20 NC tap drill)	X	X	X								
61. Tap drill extension (5/16" - 18 NC tap drill)	X	X	X								
62. Boring bar holder body jig			X								
63. Boring bar holder body		X	X								
64. Boring bar holder base	X		X			X					
65. Boring bar holder inner body	X	X	X								
66. Boring bar holder base jig	X		X								
67. Precision measuring tool block	X		X								
68. Milling arbor #40 - 3/8"		X	X					X			
69. Milling arbor #40 - 1/5"		X	X					X			
70. Milling arbor #40 - 5/8"		X	X					X			
71. Milling arbor #40 - 3/4"		X	X					X			
72. Lathe arbor	X		X					X			

SHOP PROJECTS/DUTY AREA CROSS REFERENCE MATRIX

CURRICULUM GUIDE DUTY AREAS GEORGIA MACHINE SHOP PROJECTS	A. Bench Work	B. Drilling Machine Work	C. Engine Lathe Work	D. Turret Lathe Work	E. Power Saw Work	F. Shaper Work	G. Planer Work	H. Milling Machine Work	I. Gears and Gearing	J. Grinder Work	K. Metallurgy
73. Mallet	X	X	X								
74. Acme thread/boring tool	X									X	
75. Screw jack/indexing steady rest	X	X	X					X		X	
76. Lathe chuck wrench			X					X			
77. Internal pipe wrench	X		X					X			
78. Buffer/grinder shaft	X		X					X			
79. Splitting wedge						X					
80. Flat strap clamp					X	X		X			
81. Parallel clamp	X	X	X		X	X					
82. 1-2-3 blocks I	X	X				X					
83. V-blocks	X					X		X		X	
84. Two inch step blocks						X					
85. Beveled straight edge								X		X	
86. Solid key seat	X							X			
87. Water valve wrench			X					X			
88. Paper hone		X	X					X			
89. Boring bar set		X		X	X			X			
90. U-clamp			X					X			

SHOP PROJECTS/DUTY AREA CROSS REFERENCE MATRIX

GEORGIA MACHINE SHOP PROJECTS / CURRICULUM GUIDE DUTY AREAS	A. Bench Work	B. Drilling Machine Work	C. Engine Lathe Work	D. Turret Lathe Work	E. Power Saw Work	F. Shaper Work	G. Planer Work	H. Milling Machine Work	I. Gears and Gearing	J. Grinder Work	K. Metallurgy
91. Goose neck clamp								X		X	
92. Three inch T-slot bolt			X					X			
93. 1-2-3 blocks II								X		X	
94. Three inch step blocks								X			
95. T-slot nut		X						X			
96. Die stock	X	X	X					X			
97. Geared ash tray	X		X					X			
98. Winch	X	X	X		X			X			
99. 1/4" pitch, 1" lead, Left Hand, square thread bolt			X					X			
100. Parallels								X		X	
101. Grinder test bar	X		X							X	

SECTION VI

REFERENCES, RESOURCES

RESOURCES

Instructional Resource Matrix

The Instructional Resource Matrix lists the instructional resources required to carry out the learning activities in each unit in the program. The resources are divided into the categories of audio visuals, textbooks and student materials.

Audio visuals are identified by the following symbols: slide/tapes (ST) and filmstrips (FS).

Textbooks are identified by the author(s) and title.

Student Materials are identified by the supplier and title.

Textbook List

This list identifies the textbooks referenced in the Unit Guide section and on the Instructional Resource Matrix.

Audio Visuals

The suppliers of the audio visuals referenced on the Unit Guides and the Instructional Resource Matrix are listed.

Student Materials

The suppliers of the student manuals referenced on the Unit Guides and the Instructional Resource Matrix are listed.

Additional Instructional Resources

This section lists instructional resources which may be used in addition to those primary resources listed on the Unit Guides. The resources are divided into the categories of textbooks and audio visuals.

Resource Addresses

Addresses of instructional materials referenced on the Unit Guides and in the Additional Instructional Resources section are given.

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-01 Layout metal surfaces	Bergwall: "Bench Metal Work" (FS); Prentice-Hall: "Machine Shop: Bench Operations" (FS)	Burghardt: Machine Tool Operation. (Part I); Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Benchwork Assignment Sheet #1
MS-02 Identifying jig buttons		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Tools I, Benchwork Assignment Sheet #1
MS-03 Using the sine bar	Bergwall: "Measuring Tools Explained" (FS)	Burghardt: Machine Tool Operation. (Part I); Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #3; Machine Shop Training Course, Vol. 1
MS-04 Using the bevel protractor	Bergwall: "Measuring Tools Explained" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Bench Work Assignment Sheet #4
MS-05 Using steel rules	Bergwall: "Bench Metal Work" (FS); Prentice-Hall: "Machine Shop: Bench Operations" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #5
MS-06 Using the micrometer	Bergwall: "Measuring Tools Explained" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #6

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-07 Reading a Vernier scale	Bergwall: "Measuring Tools Explained" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices: Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #7
MS-08 Using dial indicators, center testers and speed indicators	Bergwall: "Measuring Tools Explained" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #8; Machine Shop Training Course, Vol. I
MS-09 Using precision gage blocks, tapered ring, plug and snap gages	Bergwall: "Measuring Tools Explained" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #9; Machine Shop Training Course, Vol. I
MS-10 Identifying and using hand hacksaws	Bergwall: "Bench Metal Work" (FS); Prentice-Hall: "Machine Shop: Bench Operations" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #10
MS-11 Using abrasives and lapping compounds	Bergwall: "The Lathe Explained" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #11
MS-12 Identifying and using files	Bergwall: "Bench Metal Work" (FS); Prentice-Hall: "Machine Shop: Bench Operations" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #12

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-13 Scraping flat and curved bearing surfaces	Bergwall: "Bench Metal Work" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #13
MS-14 Using hammers and screwdrivers for hand bench use	Bergwall: "Bench Metal Work" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #14
MS-15 Identifying and using wrenches	Bergwall: "Bench Metal Work" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #15
MS-16 Using bench vises and clamps		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #16
MS-17 Identifying and using chipping tools		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #17; Machine Shop Training Course, Vol. 2
MS-18 Using hand taps, dies and hand reamers	Bergwall: "Bench Metal Work" (FS); Prentice-Hall: "Machine Shop: Bench Operations" (FS)	Burghardt: Machine Tool Operation. (Part I). Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #18

CURRICULUM AREA: Machine Shop

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
MS-19	Identifying power tool safety practices	Bergwall: "Working With Power Tools and Machines" (FS)	Tools and Their Uses	Ohio, Machine Trades I, Bench Work Assignment Sheet #19
MS-20	Assembling and pitting	Bergwall: "Bench Metal Work" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #20; Machine Shop Training Course, Vol. I
MS-21	Identifying fasteners	Prentice-Hall: "Working with Nuts and Bolts" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Bench Work Assignment Sheet #21; Machine Shop Training Course, Vol. I
MS-22	Using thread, center, fillet and radius gages	Bergwall: "Measuring Tools Explained" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #22; Machine Shop Training Course, Vol. I
MS-23	Identifying lubricants and greases	Bergwall: "The Lathe Explained" (FS)	Machinery's Handbook	Ohio, Machine Trades I, Bench Work Assignment Sheet #23
MS-24	Performing machine maintenance	Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Specific manufacturer's service manuals	Ohio, Machine Trades I, Bench Work Assignment Sheet #24
MS-25	Identifying bench work safety	Bergwall: "Metal Shop Safety" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Bench Work Assignment Sheet #25

CURRICULUM AREA: Machine Shop

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
MS-26	Identifying parts and functions of the drilling machine	Prentice-Hall: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #1
MS-27	Identifying safety practices and precautions when using the drilling machine	Prentice-Hall: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #2
MS-28	Identifying work-holding devices and set ups	Prentice-Hall: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #3
MS-29	Identifying and using drill bit holding devices	Prentice-Hall: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #4
MS-30	Identifying drill bits		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #5
MS-31	Identifying cutting feeds and speeds		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #6

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-32 Identifying principles of straight drilling	Bergwall: "Bench Metalwork" (FS); Prentice-Hall Media: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #7
MS-33 Identifying and using coolants and cutting compounds	Bergwall: "Bench Metalwork" (FS); Prentice-Hall Media: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #8
MS-34 Grinding and care of drills	Bergwall: "Bench Metalwork" (FS); Prentice-Hall Media: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #9
MS-35 Identifying and using twist drill gages	Bergwall: "Bench Metalwork" (FS); Prentice-Hall Media: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #10
MS-36 Identifying and using drill grinding machines	Bergwall: "Bench Metalwork" (FS); Prentice-Hall Media: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #11
MS-37 Identifying machine reamers	Bergwall: "Bench Metalwork" (FS); Prentice-Hall Media: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #6

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-38 Machine reaming	Bergwall: "Bench Metalwork" (FS); Prentice-Hall Media: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #13
MS-39 Identifying principles of boring and counterboring	Prentice-Hall Media: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #14
MS-40 Spot facing	Prentice-Hall Media: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #15
MS-41 Counter sinking and center drilling	Prentice-Hall Media: "Machine Shop: Drill Press" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #16
MS-42 Identifying lathe safety	Bergwall: "Metal Shop Safety" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #1
MS-43 Identifying lathes	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Drilling Machine Work Assignment Sheet #1

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-44 Identifying work-holding devices	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #3
MS-45 Identifying cutting tools	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #4 and #5; Machine Shop Training Course, Vol. I
MS-46 Identifying measuring tools	Bergwall: "Measuring Tools" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #6; Machine Shop Training Course, Vol. I
MS-47 Identifying lathe attachments	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work, Assignment Sheet #7
MS-48 Calculating cutting feeds and speeds on the lathe	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment #8; Machine Shop Training Course
MS-49 Determining RPM	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #9; Machine Shop Training Course, Vol. I

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-50 Center stock	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #10; Machine Shop Training Course, Vol. I
MS-51 Identifying principles of facing	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #11; Machine Shop Training Course, Vol. I
MS-52 Identifying principles of straight turning and turning to shoulders	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #12; Machine Shop Training Course, Vol. I
MS-53 Identifying chucks	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #13; Machine Shop Training Course, Vol. I
MS-54 Form turning	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #14; Machine Shop Training Course, Vol. I
MS-55 Identifying face plate work	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #16; Machine Shop Training Course, Vol. I

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-56 Using draw-in collets	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #17; Machine Shop Training Course, Vol. I
MS-57 Identifying principles of drilling	Bergwall: "Bench Metalwork" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #18; Machine Shop Training Course, Vol. I
MS-58 Identifying machine reamers	Bergwall: "Bench Metalwork" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #19; Machine Shop Training Course, Vol. I
MS-59 Reaming on the engine lathe	Bergwall: "Bench Metalwork" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignemnt Sheet #20; Machine Shop Training Course, Vol. I
MS-60 Boring on the engine lathe	Bergwall: "Bench Metalwork" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #21; Machine Shop Training Course, Vol. I
MS-61 Identifying and using mandrels	Bergwall: "Bench Metalwork" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #22; Machine Shop Training Course, Vol. I

CURRICULUM AREA: Machine Shop

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
MS-62	Knurling on the engine lathe	Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #23; Machine Shop Training Course, Vol. I
MS-63	Cutting off on the engine lathe	Bergwall: "Bench Metalwork" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #24; Machine Shop Training Course, Vol. I
MS-64	Identifying thread cutting devices	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #25; Machine Shop Training Course, Vol. I
MS-65	Identifying the parts of a thread		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #26; Machine Shop Training Course, Vol. I
MS-66	Identifying American National thread standards		Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #27; Machine Shop Training Course, Vol. I
MS-67	Computing American National thread form		Burghardt: Machine Tool Operation. (Part I)	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #28; Machine Shop Training Course, Vol. I

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-68 Computing sharp V-thread formulas		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #29; Machine Shop Training Course, Vol. I
MS-69 Identifying acme threads		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #30; Machine Shop Training Course, Vol. I
MS-70 Using the acme tap	Bergwall: "Bench Metalwork" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #31
MS-71 Identifying square threads		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #32; Machine Shop Training Course, Vol. 1
MS-72 Identifying classes of fits of screw threads		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #33
MS-73 Using thread gauges	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #34

CURRICULUM AREA: Machine Shop

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio Visuals	Textbooks	Student Materials
MS-74	Using a thread micrometer	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #35; Machine Shop Training Course, Vol. I
MS-75	Measuring threads with the three-wire method	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #36; Machine Shop Training Course, Vol. 1
MS-76	Cutting threads with an even geared lathe	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #37; Machine Shop Training Course, Vol. I; Georgia, Metals Fabrication Mathematics
MS-77	Cutting threads on a lathe which is not even greased	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #38; Georgia, Metals Fabrication Mathematics
MS-78	Cutting threads on a quick-change gear lathe	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #40; Machine Shop Training Course, Vol. I
MS-79	Identifying multiple lead screw threads	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #41

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
MS-80 Cutting left hand threads	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #42
MS-81 Determining a tap drill size	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #43; Machine Shop Training Course, Vol. II
MS-82 Cutting internal threads and tapping	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #44
MS-83 Identifying principles of taper turning	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #45; Machine Shop Training Course, Vol. I
MS-84 Computing tapers	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #46; Machine Shop Training Course, Vol. I
MS-85 Measuring short tapers	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #47; Machine Shop Training Course, Vol. I

CURRICULUM AREA: Machine Shop

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio Visuals	Textbooks	Student Materials
MS-86	Gaging inside and outside tapers	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices: Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #48
MS-87	Tapering by the offset tailstock method	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices: Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #49; Machine Shop Training Course, Vol. I
MS-88	Cutting a taper with the compound rest	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #50, Machine Shop Training Course, Vol. I
MS-89	Cutting a taper with the taper attachment	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #51
MS-90	Boring or turning internal tapers	Bergwall: "The Lathe Explained" (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe". (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #52
MS-91	Identifying coolants and cutting components	Prentice-Hall Media: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #53; Machine Shop Training Course, Vol. I

CURRICULUM AREA: Machine Shop

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
MS-92	Identifying lubricants	Bergwall: "Machine Shop: Engine Lathe" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe Machine Tool Practices	Ohio, Machine Trades I, Engine Lathe Work Assignment Sheet #54
MS-93	Identifying turret lathes		Burghardt: Machine Tool Operation. (Part I); Kibbe Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #1
MS-94	Identifying turret lathe safety practices		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #2
MS-95	Maintaining the turret lathe		Manufacturer's service or maintenance manual	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #3
MS-96	Identifying workholding devices		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #4
MS-97	Identifying chucking operations on the turret lathe		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #5
MS-98	Identifying special fixtures and steady rests		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #6
MS-99	Identifying standard tool holding devices		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #7

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
MS-100 Identifying principles of tool grinding		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #8
MS-101 Selecting cutting speed and feed on the turret lathe		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #9
MS-102 Identifying coolants and cutting compounds		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #10
MS-103 Facing on the turret lathe		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #11
MS-104 Using face plates		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #12
MS-105 Forming on the turret lathe		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #13
MS-106 Turning on the turret lathe		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #14

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-107 Drilling on the turret lathe		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #15
MS-108 Boring on the turret lathe		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #16
MS-109 Reaming on the turret lathe		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #17
MS-110 Taper turning on the turret lathe		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #18
MS-111 Chamfering and grooving on the turret lathe		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #19
MS-112 Threading on the turret lathe		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Turret Lathe Work Assignment Sheet #20
MS-113 Identifying power cut-off saws		Burghardt: Machine Tool Operation. (Part I); Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Power Saw Work Assignment Sheet #1

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-114 Identifying power saw safety		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Power Saw Work Assignment Sheet #2
MS-115 Identifying and using work holding devices on the power cut-off saw		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Power Saw Work Assignment Sheet #3
MS-116 Identifying, selecting, mounting and maintaining saw blades		Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades I, Power Saw Work Assignment Sheet #4
MS-117 Identifying speeds, feeds and coolants for power cut-off saws	Bergwall: "Bench Metalwork" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Power Saw Work Assignment Sheet #6
MS-118 Using the power cut-off for straight and angular sawing	Bergwall: "Bench Metalwork" (FS)	Burghardt: Machine Tool Operation. (Part I); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Power Saw Work Assignment Sheet #6
MS-119 Identifying the metal band saw	Bergwall: "Bench Metalwork" (FS)	Burghardt: Machine Tool Operation. (Part II) Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Power Saw Work Assignment Sheet #7

CURRICULUM AREA: Machine Shop

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
MS-120	Identifying coolants and lubricating agents for band saws	Bergwall: "Bench Metalwork" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Power Saw Work Assignment Sheet #8
MS-121	Choosing saw blades for the metal band saw	Bergwall: "Bench Metalwork" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Power Saw Work Assignment Sheet #9
MS-122	Calculating feeds and speeds for metal band saw	Bergwall: "Bench Metalwork" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices	Ohio, Machine Trades I, Power Saw Work Assignment Sheet #10
MS-123	Identifying types, sizes, construction, specifications, nomenclature and range of work for shapers		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Shaper Assignment Sheet #2, 13, 14
MS-124	Identifying shaper work holding devices and their function		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Shaper Assignment Sheet #3
MS-125	Identifying shaper cutting tools, grinding them and attaching to machine		Burghardt: Machine Tool Operation. (Part II); Porter: Machine Shop Operations and Setups; McCarthy: Machine Tool Technology	Ohio, Machine Trades II, Shaper Assignment Sheet #4

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-126 Setting up the shaper and calculating speed and feed		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Shaper Assignment Sheet #5
MS-127 Adjusting the shaper		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Shaper Assignment Sheet #6
MS-128 Performing a horizontal shaping operation		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Shaper Assignment Sheet #7
MS-129 Performing a vertical shaping operation		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Shaper Assignment Sheet #8

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-130 Shaping a rectangle or square		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Shaper Assignment Sheet #9
MS-131 Shaping a contour		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Shaper Assignment Sheet #10
MS-132 Performing angular shaping and dovetailing operations		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Shaper Assignment Sheet #11
MS-133 Cutting internal and external slots and keyways and cutting off in the shaper		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Shaper Assignment Sheet #12

CURRICULUM AREA: Machine Shop

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
MS-134	Maintaining and caring for the shaper		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Shaper Assignment Sheet #15
MS-135	Identifying types, sizes, construction, specifications, nomenclature and range of work for planers		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Work Assignment Sheet #1
MS-136	Identifying and using work holding and clamping devices		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Work Assignment Sheet #4
MS-137	Identifying planer cutting tools, grinding them and attaching to machine		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Work Assignment Sheet #4
MS-138	Setting up the planer and calculating speed and feed		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Work Assignment Sheet #6

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio Visuals	Textbooks	Student Materials
MS-139 Performing planing operations		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Work Assignment Sheet #7
MS-140 Maintaining and caring for the planer		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II Work Assignment Sheet #15
MS-141 Identifying types, sizes, construction, specifications, nomenclature and range of work for milling machines	Bergwall: "Milling Machine Explained" (FS); Prentice-Hall: "Machine Shop: Horizontal Milling Machine" (FS)	Burghardt: Machine Tool Operation. (Part II) Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Milling Assignment Sheets #1, 8
MS-142 Identifying milling machine work holding devices and their function	Bergwall: "Milling Machine Explained" (FS); Prentice-Hall: "Machine Shop: Horizontal Milling Machine" (FS) "Machine Shop: Vertical Milling Machine" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Walker: Machining Fundamentals; Porter: Machine Shop Operations and Setups	Ohic, Machine Trades II, Milling Assignment Sheet #4

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-143 Identifying, selecting and aligning milling machine attachments	Bergwall: "Milling Machine Explained" (FS); Prentice-Hall: "Machine Shop: Horizontal Milling Machine" (FS); "Machine Shop: Vertical Milling Machine" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Walker: Machining Fundamentals; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Milling Assignment Sheet #5
MS-144 Selecting and setting up milling machine cutters and holders	Bergwall: "Milling Machine Explained" (FS); Prentice-Hall: "Machine Shop: Horizontal Milling Machine" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Walker: Machining Fundamentals; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Milling Assignment Sheet #6
MS-145 Calculating cutting speeds and feeds for milling machine work	Prentice-Hall: "Machine Shop: Horizontal Milling Machine" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Walker: Machining Fundamentals; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Milling Assignment Sheet #7
MS-146 Performing a plain milling operation	Bergwall: "Milling Machine Explained" (FS); Prentice-Hall: "Machine Shop: Horizontal Milling Machine"; "Machine Shop: Vertical Milling Machine" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Walker: Machining Fundamentals; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Milling Assignment Sheet #9

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-147 Performing a face milling operation	Prentice-Hall: "Machine Shop: Horizontal Milling Machine" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Walker: Machining Fundamentals; Porter: Machine Shop Operation and Setups	Ohio, Machine Trades II, Milling Assignment Sheet #10
MS-148 Performing a side milling operation	Prentice-Hall: "Machine Shop: Vertical Milling Maching" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Milling Assignment Sheet #11
MS-149 Performing a form milling operation		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Milling Assignment Sheet #12
MS-150 Performing an angular milling operation	Prentice-Hall: "Machine Shop: Vertical Milling Machine" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Milling Assignment Sheet #13
MS-151 Performing an end milling operation	Bergwall: "Milling Machine Explained" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Porter: Machine Tool Operations and Setups	Ohio, Machine Trades II, Milling Assignment Sheet #15

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-152 Performing a gang milling operation		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; McCarthy: Machine Tool Technology; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Milling Assignment Sheet #14
MS-153 Drilling, boring and reaming with the milling machine		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Walker: Machining Fundamentals	Ohio, Machine Trades II, Milling Assignment Sheet #16
MS-154 Performing sawing, slitting and cutting off operations with the milling machine	Prentice-Hall: "Machine Shop: Horizontal Milling Machine" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups; Walker: Machining Fundamentals	Ohio, Machine Trades II, Milling Assignment Sheet #17
MS-155 Performing keyseating and T-slot milling operations	Bergwall: "Milling Machine Explained" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups; Walker: Machining Fundamentals	Ohio, Machine Trades II, Milling Assignment Sheet #18
MS-156 Performing indexing operations	Bergwall: "Milling Machine Explained" (FS); Prentice-Hall: "Machine Shop: Horizontal Milling Machine" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups; Walker: Machining Fundamentals	Ohio, Machine Trades II, Milling Assignment Sheet #19, 20, 21

CURRICULUM AREA: Machine Shop

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
MS-157	Performing circular milling operations	Bergwall: "Milling Machine Explained" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Milling Assignment Sheet #22
MS-158	Performing graduating and marking operations	Bergwall: "Milling Machine Explained" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Milling Assignment Sheet
MS-159	Performing profiling		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices	
MS-160	Maintaining and caring for the milling machine		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Milling Assignment Sheet #2
MS-161	Identifying types of gears and their function		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Gear Assignment Sheet #1
MS-162	Identifying gear tooth elements and their symbols		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Gear Assignment Sheet #4
MS-163	Calculating the pitch, diameters, working depth and clearances for machining gears		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Gear Assignment Sheet #5, 6, 7, 8

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-164 Milling a spur gear	Prentice-Hall: "Machine Shop: Horizontal Milling Machine" (FS)	Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Gear Assignment Sheet #3
MS-165 Milling a gear rack		Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Gear Assignment Sheet #9
MS-166 Milling a stub gear	Bergwall: "Milling Machine Explained" (FS); Prentice-Hall: "Machine Shop: Horizontal Milling Machine" (FS)	Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Gear Assignment Sheet #10
MS-167 Milling a bevel gear	Bergwall: "Milling Machine Explained" (FS)	Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Gear Assignment Sheet #11, 12, 13
MS-168 Machining a worm gear on the engine lathe		Burghardt: Machine Tool Operation. (Part II)	Ohio, Machine Trades II, Gear Assignment Sheet #14, 15, 16
MS-169 Identifying grinders, grinding wheels and attachments	Bergwall: "The Grinding Machine" (FS)	Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Gear Assignment Sheet #1-12
MS-170 Using the bench grinder		Walker: Machining Fundamentals	Ohio, Machine Trades II, Bench Grinder Assignment Sheet #1-4
MS-171 Using the surface grinder	Bergwall: "The Grinding Machine" (FS)	Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Surface Grinder Assignment Sheet #1-10
MS-172 Using the cylindrical grinder		Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Cylindrical Grinder Assignment Sheet #1-13

CURRICULUM AREA: Machine Shop

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MS-173 Using the tool and cutter grinder		Kibbe: Machine Tool Practices	Ohio, Machine Trades II Tool and Cutter Grinder Assignment Sheet #1-8
MS-174 Using the centerless grinder		Burghardt: Machine Tool Operation. (Part II)	Ohio, Machine Trades II, Centerless Grinder Assignment Sheet #1-7
MS-175 Performing honing and lapping operations		Porter: Machine Shop Operations and Setups	Ohio, Machine Trades II, Honing and Lapping Assignment Sheet #1-5
MS-176 Identifying metal manufacturing processes	Bergwall: "Foundry Work" (FS)	Kibbe: Machine Tool Practices	
MS-177 Identifying the physical structure of metals		Burghardt: Machine Tool Operation. (Part II); Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Metallurgy Assignment Sheet #1
MS-178 Identifying properties of metals		Burghardt: Machine Tool Operation. (Part II)	Ohio, Machine Trades II, Metallurgy Assignment Sheet #2
MS-179 Identifying methods of heat treatment		Burghardt: Machine Tool Operation. (Part II)	Ohio, Machine Trades II, Heat Treating Assignment Sheet #1-11
MS-180 Identifying iron manufacturing processes		Burghardt: Machine Tool Operation. (Part II)	Ohio, Machine Trades II, Metallurgy Assignment Sheet #3, 4

CURRICULUM AREA: Machine Shop

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
MS-181	Identifying processes used to produce steel		Burghardt: Machine Tool Operation. (Part II)	Ohio, Machine Trades II, Metallurgy Assignment Sheet #6-13
MS-182	Identifying processes used to produce copper, brass and bronze alloys		Burghardt: Machine Tool Operation. (Part II)	Ohio, Machine Trades II, Metallurgy Assignment Sheet #14
MS-183	Identifying processes used to produce aluminum		Burghardt: Machine Tool Operation. (Part II)	Ohio, Machine Trades II, Metallurgy Assignment Sheet #15
MS-184	Identifying processes for the production of magnesium and titanium		Kibbe: Machine Tool Practices	Ohio, Machine Trades II, Metallurgy Assignment Sheet #16

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AUDIO VISUALS

Automated Training, Inc.	Filmstrips, 16mm Cartridge
Bennett Publishing Company	Transparencies
Bergwall Productions, Inc.	Filmstrips
Career Aids, Inc.	Filmstrips
DCA Educational Products	Transparencies, 8mm Film Loops
Prentice Hall Media	Filmstrips

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Audio Visuals

AAVIM	Slide/Tape

RESOURCE ADDRESSES

AAVIM
120 Engineering Center
Athens, GA 30602

American Tech
5608 Stony Island Avenue
Chicago, IL 60637

Bennett Publishing Company
809 W. Detweiller Dr.
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Peoria, IL 61615

Bergwall Productions, Inc.
839 Stewart Avenue
Garden City, NY 11530

Bobbs-Merrill Educational
Publishing
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4300 West 62nd Street
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California State Dept. of
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Chatsworth, CA 91311

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Curriculum Development
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The University of Texas at
Austin
Austin, TX 78712

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Montgomery, AL 36111

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Tallahassee, FL 32306

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Georgia Department of Education
Atlanta, GA 30334

Goodheart-Willcox Co.
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South Holland, IL 60473

Gregg/McGraw-Hill
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New York, NY 10057

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Columbia, MO 65211

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College Station, TX 77843

Vocational-Technical
Curriculum Laboratory
Rutgers-The State University
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New Brunswick, NJ 08903

Wisconsin Vocational Studies
Center
University of Wisconsin-
Madison
964 Educational Services
Building
1025 W. Johnson St.
Madison, WI 53706

SECTION VII

STUDENT RECORDS

STUDENT RECORDS

This section contains three forms, the Individual Progress Report Chart, the Group Progress Chart and the Student Competency Record. The use of these charts is described below.

INDIVIDUAL PROGRESS REPORT. One copy should be kept in each student's confidential file and updated as tasks are completed. Grades should be assigned upon task completion and then averaged for grade reporting. Difficulty, excessive amounts of time, etc. should be noted on this form and should be discussed with the student and/or parents.

GROUP PROGRESS CHART. This chart reflects task completion only and can be displayed in the classroom or lab area. Due to confidentiality of records, a grade must not be recorded. The instructor should maintain a copy of this record and update it daily.

STUDENT COMPETENCY RECORD. This record provides a listing of all tasks or units in the program, a space designated for the student's name, D.O.T. numbers and job title and a check off column for date of task completion. The D.O.T. number and job title should be filled in when the student leaves the program for any reason. The information will indicate his/her qualifications for a job. This information will be especially useful to early leavers who have not completed the total program. The Task Listing/D.O.T. Code Cross Reference Table in Section III contains the information required to identify the particular job title for which the student is qualified.

INDIVIDUAL PROGRESS REPORT

NAME

PROGRAM/ CLUSTER **AREA**

TASK/ UNIT NO.	UNIT TITLE	DATE STARTED	DATE COMP.	EST. TIME	GRADE

GROUP PROGRESS CHART

NAME	UNITS/TASKS																				

COMPETENCY CHECKLIST

The Competency Checklist is an easy device for the instructor to use to know when a student is eligible to receive a Certificate of Competency (shown on page 9). One Checklist is used per student for as long as the student stays in the program. The instructor may use the checklist in the following manner.

1. Enter the student's name on the form.
2. As the student masters each task, check-off the task under each job title on the Competency Checklist for which it appears.
3. Keep the Checklist in each student's personal file or keep all Competency Checklists together in a separate file.
4. When all the tasks underneath a job title have been checked-off, the student is eligible to receive a Certificate of Competency for that job title.

CERTIFICATE OF COMPETENCY

The Certificate of Competency is issued by the instructor to certify that the student has mastered the tasks necessary for entry level employment for the job listed on the Certificate. The specific tasks that have been mastered are printed on the back of the Certificate, which can be used by the student to show a prospective employer exactly what the student is qualified to do. The Certificates should be printed ahead of time so that the instructor may simply fill in the front of the Certificate whenever a student is eligible to receive one, as indicated by the student's Competency Checklist. A sample completed Certificate of Competency appears on page 9 followed by a Certificate of Competency for each of the possible Machine Shop Program exit points (job titles).

The Certificate should be completed by the instructor as follows:

1. Enter the student's name.
2. Enter the school name.
3. Date and sign the Certificate.
4. It is recommended that the Certificate be stamped with the school seal.

COMPETENCY CHECKLIST

____
STUDENT NAME

As the student masters each unit of instruction, check off the unit number under each of the following job titles where it appears. When all the units under a job title have been completed, the student is eligible to receive a Certificate of Competency for that job title.

Grinder Operator
603.280-018

- ( ) MS-01
- ( ) MS-02
- ( ) MS-03
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Milling Machine Operator
605.685-030

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Drill Press Operator
606.682-014

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Lathe Operator
604.685-026

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Machinist

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CERTIFICATE OF COMPETENCY

This is to Certify that

D. Michelle Watkins

of

SAMPLE

Athens Area Vo-Tech School

has successfully mastered the competencies required to perform the job of *MILLING MACHINE OPERATOR*.

Elvira Jones

July 8, 1968

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Milling Machine Operator.

MILLING MACHINE OPERATOR
605.685-030

Duty A: Bench Work

Laying out metal surfaces
Identifying jig buttons
Using the sine bar
Using the bevel protractor
Using steel rules
Using the micrometer
Reading a Vernier scale
Using dial indicators, center testers and speed indicators
Using precision gage blocks, tapered ring, plug and snap gages
Identifying and using hand hacksaws
Using abrasives and lapping compounds
Identifying and using files
Scraping flat and curved bearing surfaces
Using hammers and screwdrivers for hand bench use
Identifying and using wrenches
Using bench vices and clamps
Identifying and using chipping tools
Using hand taps, dies and hand reamers
Identifying power tool safety practices
Assembling and pitting
Identifying fasteners
Using thread, center, fillet and radius gages
Identifying lubricants and greases
Performing machine maintenance
Identifying bench work safety

Duty H: Milling Machine Work

Identifying types, sizes, construction, specifications, nomenclature and range of work for milling machines
Identifying milling machine work holding devices and their function
Identifying, selecting and aligning milling machine attachments
Selecting and setting up milling machine cutters and holders
Calculating cutting speeds and feeds for milling machine work
Performing a plain milling operation
Performing a face milling operation
Performing a side milling operation
Performing a form milling operation
Performing an angular milling operation
Performing an end milling operation
Performing a gang milling operation
Drilling, boring and reaming with the milling machine
Performing sawing, slitting and cutting off operations with the milling machine
Performing keyseating and T-slot milling operations
Performing indexing operations
Performing circular milling operations
Performing graduating and marking operations
Performing profiling
Maintaining and caring for the milling machine

Duty I: Gears and Gearing

Identifying types of gears and their function
Identifying gear tooth elements and their symbols
Calculating the pitch, diameters, working depth and clearances for machining gears
Milling a spur gear
Milling a gear rack
Milling a stub gear
Milling a bevel gear
Machining a worm gear on the engine lathe

CERTIFICATE OF COMPETENCY

This is to Certify that

____

of

____

has successfully mastered the competencies required to perform the job of

Grinder Operator

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Grinder Operator.

GRINDER OPERATOR
603.280-018

Duty A: Bench Work

Laying out metal surfaces
Identifying jig buttons
Using the sine bar
Using the bevel protractor
Using steel rules
Using the micrometer
Reading a Vernier scale
Using dial indicators, center testers and speed indicators
Using precision gage blocks, tapered ring, plug and snap gages
Identifying and using hand hacksaws
Using abrasives and lapping compounds
Identifying and using files
Scraping flat and curved bearing surfaces
Using hammers and screwdrivers for hand bench use
Identifying and using wrenches
Using bench vices and clamps
Identifying and using chipping tools
Using hand taps, dies and hand reamers
Identifying power tool safety practices
Assembling and pitting
Identifying fasteners
Using thread, center, fillet and radius gages
Identifying lubricants and greases
Performing machine maintenance
Identifying bench work safety

Duty J: Grinder Work

Identifying grinders, grinding wheels and attachments
Using the bench grinder
Using the surface grinder
Using the cylindrical grinder
Using the tool cutter and grinder
Using the centerless grinder
Performing honing and lapping operations

CERTIFICATE OF COMPETENCY

This is to Certify that

____

of

____

has successfully mastered the competencies required to perform the job of

Drill Press Operator

____

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Drill Press Operator.

DRILL PRESS OPERATOR
606.682-014

Duty A: Bench Work

Laying out metal surfaces
Identifying jig buttons
Using the sine bar
Using the bevel protractor
Using steel rules
Using the micrometer
Reading a Vernier scale
Using dial indicators, center testers and speed indicators
Using precision gage blocks, tapered ring, plug and snap gages
Identifying and using hand hacksaws
Using abrasives and lapping compounds
Identifying and using files
Scraping flat and curved bearing surfaces
Using hammers and screwdrivers for hand bench use
Identifying and using wrenches
Using bench vices and clamps
Identifying and using chipping tools
Using hand taps, dies and hand reamers
Identifying power tool safety practices
Assembling and pitting
Identifying fasteners
Using thread, center, fillet and radius gages
Identifying lubricants and greases
Performing machine maintenance
Identifying bench work safety

Duty B: Drilling Machine Work

Identifying parts and functions of the drilling machine
Identifying safety practices and precautions when using the drilling machine
Identifying work-holding devices and set ups
Identifying and using drill bit holding devices
Identifying drill bits
Identifying cutting feeds and speeds
Identifying principles of straight drilling
Identifying and using coolants and cutting compounds
Grinding and care of drills
Identifying and using twist drill gages
Identifying and using drill grinding machines
Identifying machine reamers
Machine reaming
Identifying principles of boring and counterboring
Spot facing
Counter sinking, center drilling and tapping

CERTIFICATE OF COMPETENCY

This is to Certify that

____

of

____

has successfully mastered the competencies required to perform the job of

Milling Machine Operator

____

____

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Milling Machine Operator.

MILLING MACHINE OPERATOR
605.685-030

Duty A: Bench Work

Laying out metal surfaces
Identifying jig buttons
Using the sine bar
Using the bevel protractor
Using steel rules
Using the micrometer
Reading a Vernier scale
Using dial indicators, center testers and speed indicators
Using precision gage blocks, tapered ring, plug and snap gages
Identifying and using hand hacksaws
Using abrasives and lapping compounds
Identifying and using files
Scraping flat and curved bearing surfaces
Using hammers and screwdrivers for hand bench use
Identifying and using wrenches
Using bench vices and clamps
Identifying and using chipping tools
Using hand taps, dies and hand reamers
Identifying power tool safety practices
Assembling and pitting
Identifying fasteners
Using thread, center, fillet and radius gages
Identifying lubricants and greases
Performing machine maintenance
Identifying bench work safety

Duty H: Milling Machine Work

Identifying types, sizes, construction, specifications, nomenclature and range of work for milling machines
Identifying milling machine work holding devices and their function

Identifying, selecting and aligning milling machine attachments
Selecting and setting up milling machine cutters and holders
Calculating cutting speeds and feeds for milling machine work
Performing a plain milling operation
Performing a face milling operation
Performing a side milling operation
Performing a form milling operation
Performing an angular milling operation
Performing an end milling operation
Performing a gang milling operation
Drilling, boring and reaming with the milling machine
Performing sawing, slitting and cutting off operations with the milling machine
Performing keyseating and T-slot milling operations
Performing indexing operations
Performing circular milling operations
Performing graduating and marking operations
Performing profiling
Maintaining and caring for the milling machine

Duty I: Gears and Gearing

Identifying types of gears and their function
Identifying gear tooth elements and their symbols
Calculating the pitch, diameters, working depth and clearances for machining gears
Milling a spur gear
Milling a gear rack
Milling a stub gear
Milling a bevel gear
Machining a worm gear on the engine lathe

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

Lathe Operator

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Lathe Operator.

LATHE OPERATOR
604.685-026

Duty A: Bench Work

Laying out metal surfaces
Identifying jig buttons
Using the sine bar
Using the bevel protractor
Using steel rules
Using the micrometer
Reading a Vernier scale
Using dial indicators, center testers and speed indicators
Using precision gage blocks, tapered ring, plug and snap gages
Identifying and using hand hacksaws
Using abrasives and lapping compounds
Identifying and using files
Scraping flat and curved bearing surfaces
Using hammers and screwdrivers for hand bench use
Identifying and using wrenches
Using bench vices and clamps
Identifying and using chipping tools
Using hand taps, dies and hand reamers
Identifying power tool safety practices
Assembling and pitting
Identifying fasteners
Using thread, center, fillet and radius gages
Identifying lubricants and greases
Performing machine maintenance
Identifying bench work safety

Duty C: Engine Lathe Work

Identifying lathe safety
Identifying lathes
Identifying work-holding devices
Identifying cutting tools
Identifying measuring tools
Identifying lathe attachments
Calculating cutting feeds and speeds on the lathe
Determining RPM
Centering stock
Identifying principles of facing
Identifying principles of straight turning and turning to shoulders
Identifying checks
Form turning
Identifying face plate work
Using draw-in collets
Identifying principles of drilling
Identifying machine reamers
Reaming on the engine lathe
Boring on the engine lathe
Identifying and using mandrels
Knurling on the engine lathe
Cutting off on the engine lathe
Identifying thread cutting devices
Identifying the parts of a thread
Identifying American National Thread standards
Computing American National Thread form
Computing sharp V-thread formulas
Identifying acme threads
Using the acme tap
Identifying square threads
Identifying classes of fits of screw threads
Using thread gages
Using a thread micrometer
Measuring threads with the three-wire method
Cutting threads with an even geared lathe
Cutting threads on a lathe which is not even geared
Cutting threads on a quick-change gear lathe
Identifying multiple lead screw threads
Cutting left hand threads
Determining a tap drill size
Cutting interval threads and tapping
Identifying principles of taper turning
Computing tapers
Measuring short tapers
Gaging inside and outside tapers
Tapering by the offset tail stock methods
Cutting a taper with the compound rest
Cutting a taper with the taper attachment
Boring or turning interval tapers
Identifying coolants and cutting compounds
Identifying lubricants

Duty D: Turret Lathe Work

Identifying turret lathes
Identifying turret lathe safety practices
Maintaining the turret lathe
Identifying work holding devices
Identifying chucking operations on the turret lathe
Identifying special fixtures and steady rests
Identifying standard tool holding devices
Identifying principles of tool grinding
Selecting cutting speed and feed on the turret lathe
Identifying coolants and cutting compounds
Facing on the turret lathe
Using face plates
Forming on the turret lathe
Turning on the turret lathe
Drilling on the turret lathe
Boring on the turret lathe
Reaming on the turret lathee
Taper turning on the turet lathe
Chamfering and grooving on the turret lathe
Threading on the turret lathe

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

Machinist

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The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Machinist.

MACHINIST
600.280-022

Duty A: Bench Work

Laying out metal surfaces
Identifying jig buttons
Using the sine bar
Using the bevel protractor
Using steel rules
Using the micrometer
Reading a Vernier Scale
Using dial indicators, center testers and speed indicators
Using precision gage blocks, tapered ring, plug and snap gages
Identifying and using hand hacksaws
Using abrasives and lapping compounds
Identifying and using files
Scraping flat and curved bearing surfaces
Using hammers and screwdrivers for hand bench use
Identifying and using wrenches
Using bench vices and clamps
Identifying and using chipping tools
Using hand taps, dies and hand reamers
Identifying power tool safety practices
Assembling and pitting
Identifying fasteners
Using thread, center, fillet and radius gages
Identifying lubricants and greases
Performing machine maintenance
Identifying bench work safety

Duty B: Drilling Machine Work

Identifying parts and functions of the drilling machine
Identifying safety practices and precautions when using the drilling machine
Identifying work-holding devices and setups
Identifying and using drill bit holding devices

Computing sharp V-thread formulas
Identifying acme threads
Using the acme tap
Identifying square threads
Identifying classes of fits of screw threads
Using threads gages
Using a thread micrometer
Measuring threads with the three-wire method
Cutting threads with an even geared lathe
Cutting threads on a lathe which is not even geared
Cutting threads on a quick-change gear lathe
Identifying multiple lead screw threads
Cutting left hand threads
Determining a tap drill size
Cutting interval threads and tapping
Identifying principles of taper turning
Computing tapers
Measuring short tapers
Gaging inside and outside tapers
Tapering by the offset tail stock methods
Cutting a taper with the compound rest
Cutting a taper with the taper attachment
Boring or turning interval tapers
Identifying coolants and cutting compounds
Identifying lubricants

Duty D: Turret Lathe Work

Identifying turret lathes
Identifying turret lathe safety practices
Maintaining the turret lathe
Identifying work holding devices
Identifying chucking operations on the turret lathe
Identifying special fixtures and steady rests
Identifying standard tool holding devices
Identifying principles of tool grinding
Selecting cutting speed and feed on the turret lathe

Cutting internal and external slots and keyways and cutting off in the shaper
Maintaining and caring for the shaper

Duty G: Planer Work

Identifying types, sizes, construction, specifications, nomenclature and range of work for planers
Identifying and using work holding and clamping devices
Identifying planer cutting tools, grinding them and attaching to machine
Setting up the planer and calculating speed and feed
Performing planing operations
Maintaining and caring for the planer

Duty H: Milling Machine Work

Identifying types, sizes, construction, specifications, nomenclature and range of work for milling machines
Identifying milling machine work holding devices and their function
Identifying, selecting and aligning milling machine attachments
Selecting and setting up milling machine cutters and holders
Calculating cutting speeds and feeds for milling machine work
Performing a plain milling operation
Performing a face milling operation
Performing a side milling operation
Performing a form milling operation
Performing an angular milling operation
Performing an end milling operation
Performing a gang milling operation
Drilling, boring and reaming with the milling machine

Identifying drill bits
Identifying cutting feeds and speeds
Identifying principles of straight drilling
Identifying and using coolants and cutting compounds
Grinding and care of drills
Identifying and using twist drill gages
Identifying and using drill grinding machines
Identifying machine reamers
Machine reaming
Identifying principles of boring and counterboring
Spot facing
Counter sinking, center drilling, and tapping

Duty C: Engine Lathe Work

Identifying lathe safety
Identifying lathes
Identifying work-holding devices
Identifying cutting tools
Identifying measuring tools
Identifying lathe attachments
Calculating cutting feeds and speeds on the lathe
Determining RPM
Centering stock
Identifying principles of facing
Identifying principles of straight turning and turning to shoulders
Identifying checks
Form turning
Identifying face plate work
Using draw-in collets
Identifying principles of drilling
Identifying machine reamers
Reaming on the engine lathe
Boring on the engine lathe
Identifying and using mandrels
Knurling on the engine lathe
Cutting off on the engine lathe
Identifying thread cutting devices
Identifying the parts of a thread
Identifying American National Thread standards
Computing American National Thread form
Identifying coolants and cutting compounds
Facing on the turret lathe
Using face plates
Forming on the turret lathe
Turning on the turret lathe
Drilling on the turret lathe
Boring on the turret lathe
Reaming on the turret lathe
Taper turning on the turret lathe
Chamfering and grooving on the turret lathe
Threading on the turret lathe

Duty E: Power Saw Work

Identifying power cut-off saws
Identifying power saw safety
Identifying and using work holding devices on the power cut-off saw
Identifying, selecting, mounting and maintaining saw blades
Identifying speeds, feeds and coolants for power cut-off saws
Using the power cut-off saw for straight and angular sawing
Identifying the metal band saw
Identifying coolants and lubricating agents for band saws
Choosing saw blades for the metal band saw
Calculating feeds and speeds for the metal band saw

Duty F: Shaper Work

Identifying types, sizes, construction, specifications, nomenclature and range of work for shapers
Identifying shaper work holding devices and their function
Identifying shaper cutting tools, grinding them and attaching to machine
Setting up the shaper and calculating speed and feed
Adjusting the shaper
Performing a horizontal shaping operation
Performing a vertical shaping operation
Shaping a rectangle or square
Shaping a contour
Performing angular shaping and dovetailing operations
Performing sawing, slitting and cutting off operations with the milling machine
Performing keyseating and T-slot milling operations
Performing indexing operations
Performing circular milling operations
Performing graduating and marking operations
Performing profiling
Maintaining and caring for the milling machine

Duty I: Gears and Gearing

Identifying types of gears and their function
Identifying gear tooth elements and their symbols
Calculating the pitch, diameters, working depth and clearances for machining gears
Milling a spur gear
Milling a gear rack
Milling a stub gear
Milling a bevel gear
Machining a worm gear on the engine lathe

Duty J: Grinder Work

Identifying grinders, grinding wheels and attachments
Using the bench grinder
Using the surface grinder
Using the cylindrical grinder
Using the tool and cutter grinder
Using the centerless grinder
Performing honing and lapping operations

Duty K: Metallurgy

Identifying metal manufacturing processes
Identifying the physical structure of metals
Identifying properties of metals
Identifying methods of heat treatment
Identifying iron manufacturing processes
Identifying processes used to produce steel
Identifying processes used to produce copper, brass, and bronze alloys
Identifying processes used to produce aluminum
Identifying processes for the production of magnesium and titanium

SECTION VIII

SPECIAL NEEDS STUDENT

WORKING WITH SPECIAL NEEDS STUDENTS

Introduction

Special needs students are those who are designated as handicapped and/or disadvantaged. The 1976 vocational education amendment defines handicapped individuals as:

> Persons who are mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, health impaired, or persons with other specific disabilities, who by reason thereof require special education and related services and who cannot succeed in the regular vocational education programs.

In Title II of the 1976 education amendments disadvantaged persons are defined as:

> Persons (other than handicapped persons) who have academic or economic disadvantages and who require special services, assistance or programs in order to enable them to succeed in vocational education programs.

Federal legislation requires that these special people be given an opportunity to function in a regular classroom. This section provides information on how special needs students are identified and how they can be mainstreamed into regular educational environments.

Figure One presents a model depicting various activities of the process in identifying and mainstreaming special needs students. These activities are conducted at three levels: the system level, the school level and the classroom level. All three levels must work together if implementation of the process is to be effective.

Identification Of The Special Needs Student

Through a variety of pre-testing procedures, special needs students are identified and their potentials are evaluated at the

SPECIAL NEEDS MAINSTREAMING MODEL

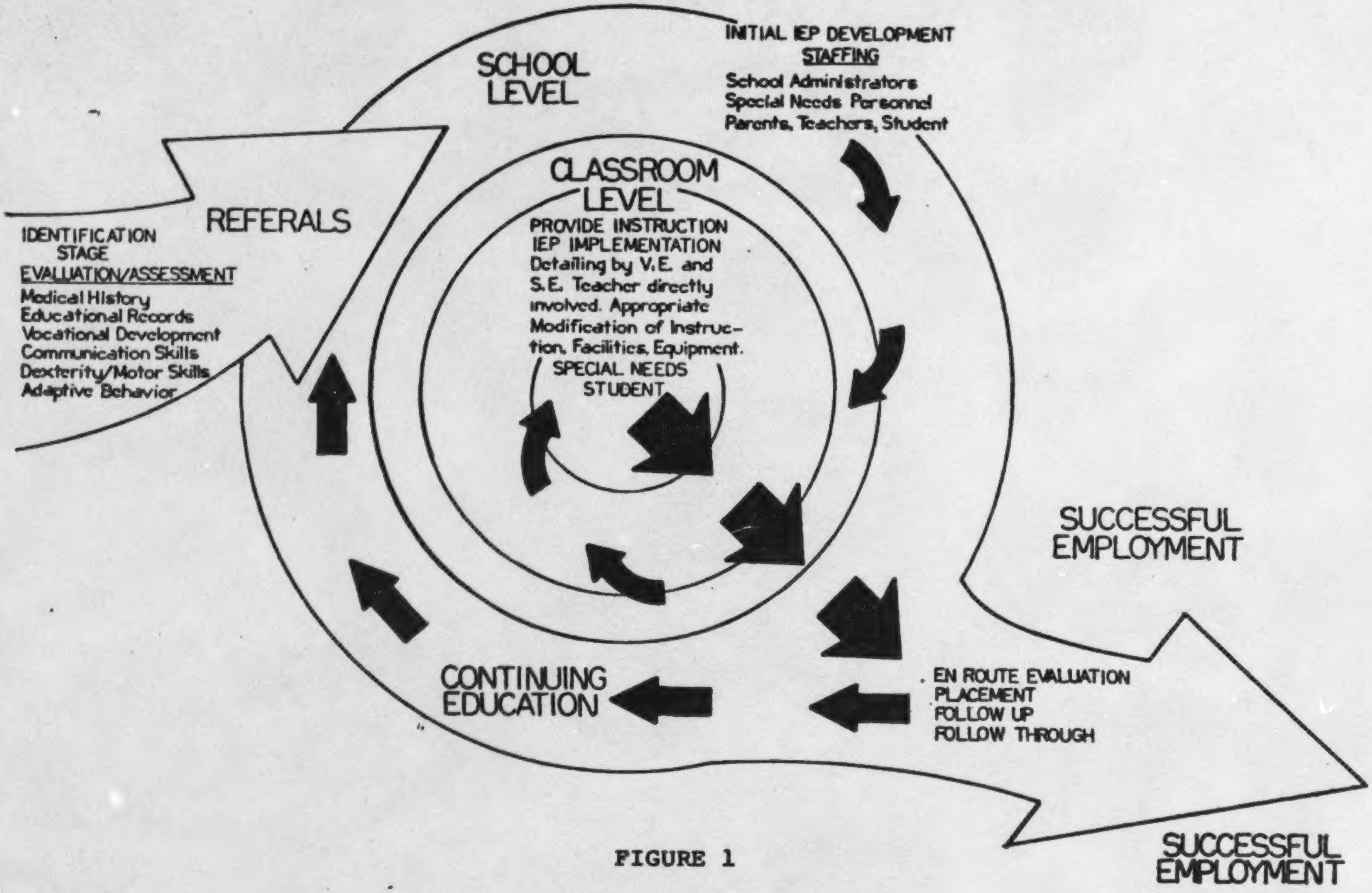
SCHOOL LEVEL
INITIAL IEP DEVELOPMENT
STAFFING
School Administrators
Special Needs Personnel
Parents, Teachers, Student
CLASSROOM LEVEL
PROVIDE INSTRUCTION
IEP IMPLEMENTATION
Detailing by V.E. and S.E. Teacher directly involved. Appropriate Modification of Instruction, Facilities, Equipment.
SPECIAL NEEDS STUDENT
REFERALS
IDENTIFICATION STAGE
EVALUATION/ASSESSMENT
Medical History
Educational Records
Vocational Development
Communication Skills
Dexterity/Motor Skills
Adaptive Behavior
SUCCESSFUL EMPLOYMENT
CONTINUING EDUCATION
EN ROUTE EVALUATION
PLACEMENT
FOLLOW UP
FOLLOW THROUGH
SUCCESSFUL EMPLOYMENT

FIGURE 1

system level. This evaluation process consists of collecting and assessing the following data for each student:

- -Medical History
- -Educational Records
- -Vocational Development
- -Communication Skills
- -Dexterity/Motor Skills
- -Adaptive Behavior

When this procedure has been completed, the system personnel refers the student to the appropriate school level personnel.

Development of the Plan

At the school level, an Individual Education Plan (IEP) is developed for each special needs student. An IEP is a written plan which describes the educational objectives, both long and short term, and the support services for a special needs student. The plan is developed by the school administration, special education personnel, teacher(s) directly involved with the student and the parent(s). In some cases, the student may help with the development.

Implementing the I.E.P.

The actual implementing of the I.E.P. begins at the classroom level. The purpose of the teacher dealing with the special needs student is to help the student set realistic goals, identify the barriers which make it difficult for the student to learn and adapt the curriculum and/or facilities with reference to the I.E.P. so the student can learn while overcoming personal barriers.

Special needs students have problems which hinder their learning. Therefore, a teacher's job becomes more complicated than when teaching "regular" students. Handicapped students may have a variety of problems - mental, physical and/or emotional.

Academically disadvantaged students may exhibit language deficiencies, reading and writing deficiencies, computational deficiencies and general educational deficiencies. Economically disadvantaged students may possess an inability to concentrate because their primary needs - food, shelter, clothing - are not adequately met due to lack of money.

By considering these problems, teachers can modify existing programs to accommodate the needs of special needs learners. Some suggestions which may prove beneficial in modifying an existing curriculum are listed below:

- Prepare instructional materials in greater detail and assign work in shorter units.
- Provide more frequent evaluation of student's progress and provide opportunities for remedial work.
- Be aware of the student's limited vocabulary.
- Be aware of the student's inability to understand abstractions and generalizations and prepare materials accordingly.
- Keep the student aware of his or her progress and make the student feel he or she can succeed.
- Use real teaching aids, live work and practical experiences whenever possible.
- Choose reading material which is at the student's level, interest and experience.
- Use constructive criticism only.
- Use peer instruction whenever possible.
- Allow the student to advance at his or her own pace.
- Use the part-to-whole learning concept in adapting materials.

Facility Modifications

In some cases, facilities must be modified for handicapped special needs students. In general, as long as the classroom/

shop meets federal guidelines for barrier free design, extensive facility changes need not be made. For visually impaired students, for example, let the student locate in the classroom where he or she can see best even to the point of moving the desk or work station as a portable unit. In the case of orthopedically handicapped, some changes may have to be made to shop machinery to allow the student to use it. This may involve more convenient controls or special seating where the student would normally stand. In making these changes, special education expertise would be helpful.

Evaluation

Evaluation of the student's program should consist of:

-En-route evaluation (formative) to monitor the student's progress through the program.

-Summative evaluation upon completion of the program to determine job readiness.

-Follow-up after placement to determine if the student is successful on the job.

-Follow-through activities designed to identify any further training needed, which is indicated by the follow-up procedure.

Working with special needs students is much more demanding of the system, the school and the classroom teacher. However, with their patience and understanding, special needs students can not only succeed, but in many cases excell.

RESOURCES

To aid the teacher in modifying materials for special needs categories, the following references are listed by category. These are suggested references only as a world of materials exist on this subject.

Mentally Retarded

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Nix, Gary W. Mainstreaming Education for Hearing Impaired Children and Youth. Grune and Stratton, 1976.

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Mallix, Kalisanker and Mueller, Jim. Vocational Aids and Enhanced Productivity of the Severely Disabled. The George Washington University Rehabilitation Research and Training Center, Washington, D.C. 1975.

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A Handbook for Developing Programs and Services for Disadvantaged Students. Department of Vocational Education Studies, College of Education, Southern Illinois, University of Carbondale, Carbondale, Ill. 62901

By Program

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Auto Body: An Adaptive and Developmental Program for Special Needs Students. Vocational-Technical Curriculum Laboratory, Rutgers - The State University, New Brunswick, N.J. 1976.

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Home Economics and the Exceptional Student: A Handbook for Home Economics Teachers Working with Mentally Retarded Students. Vocational-Technical Curriculum Laboratory, Rutgers - The State University, New Brunswick, N.J. 1976.

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3100209 Student

-CVET General Mechanics 3100239 Teacher's Guide
3100229 Student

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SECTION IX

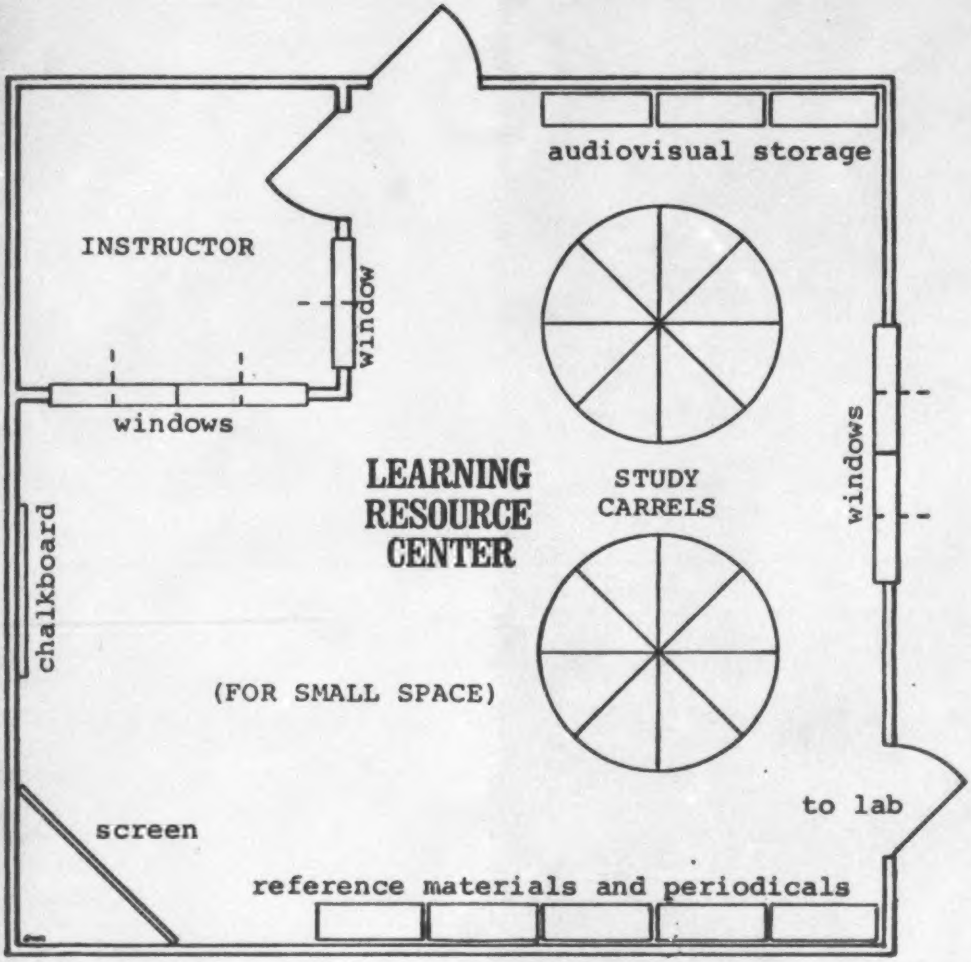
FACILITY LAYOUT

Facility Layout

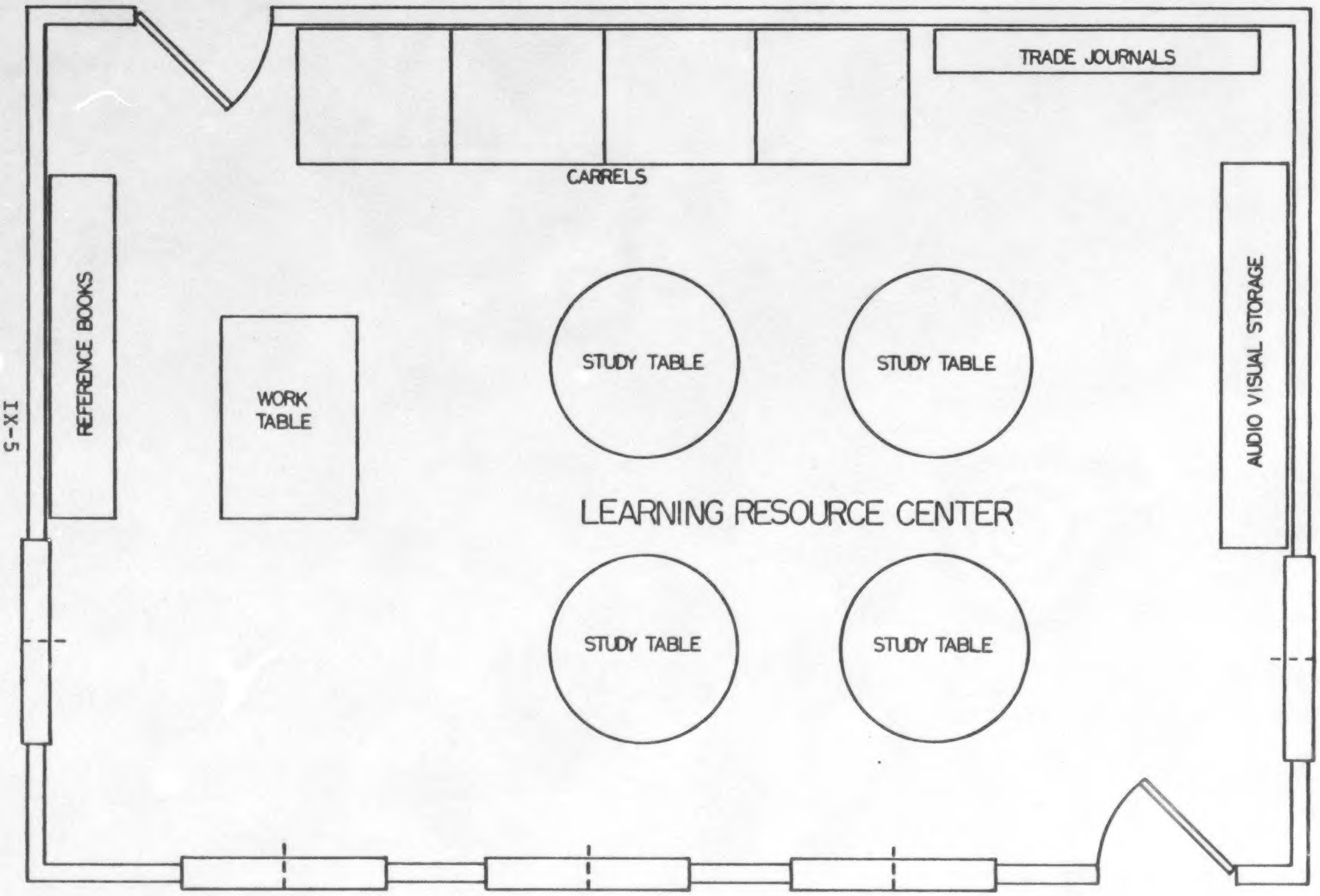
The facility layouts on the following pages are presented to aid in arranging the classroom and laboratory for efficient instruction. The three resource center arrangements represent small, medium and large centers. Ultimately the instructor must determine an arrangement that best fits the needs of the students and the instructional method being used.

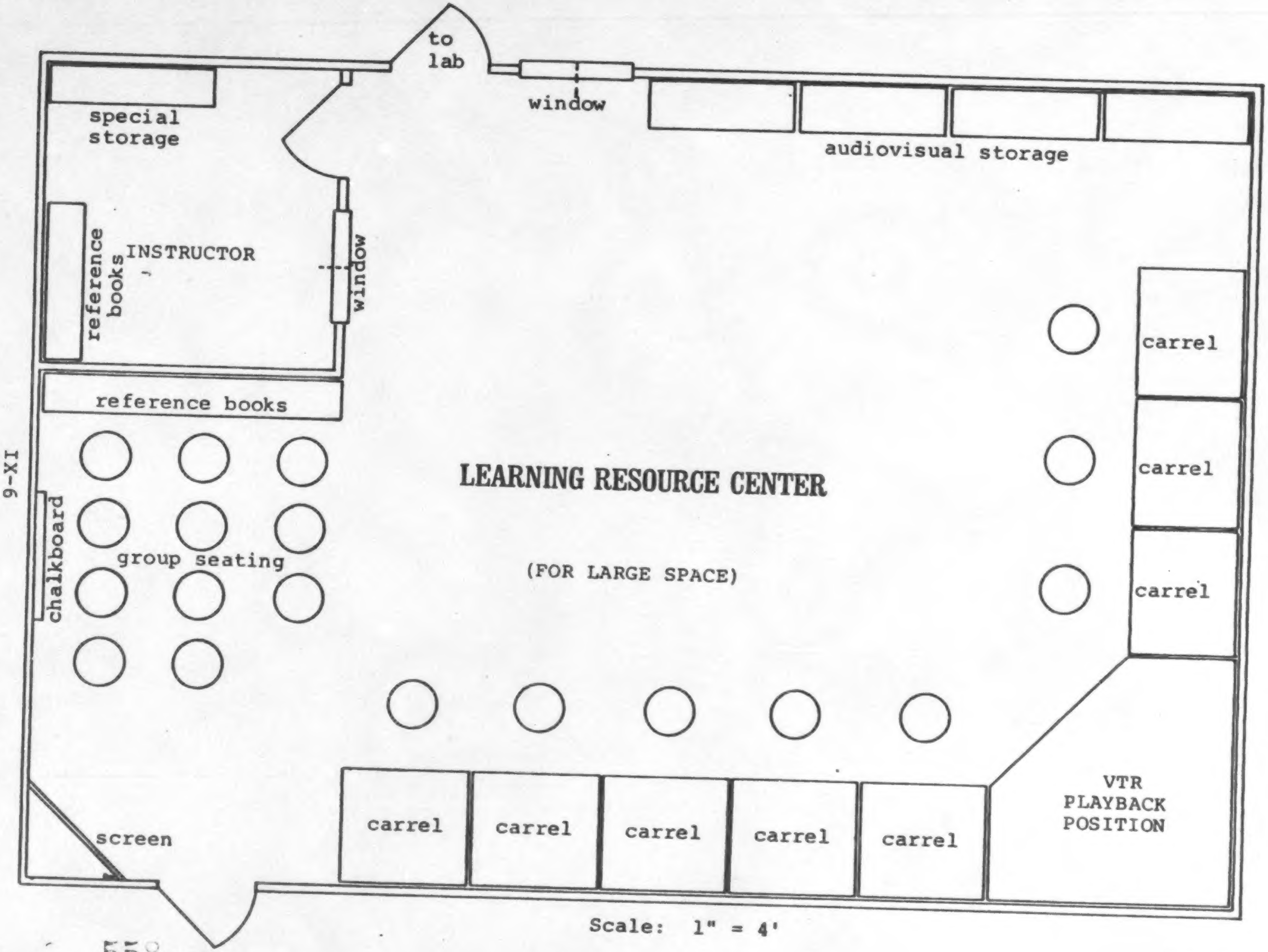
The laboratory facility layout is one recommended by the teachers who helped develop the Machine Shop program materials. This facility is easily adaptable to a variety of arrangements that will best fit local needs.

These layouts may be especially useful in those schools where classroom renovation or construction is being planned.


audiovisual storage
INSTRUCTOR
window
windows
LEARNING RESOURCE CENTER
STUDY CARRELS
windows
chalkboard
(FOR SMALL SPACE)
to lab
screen
reference materials and periodicals

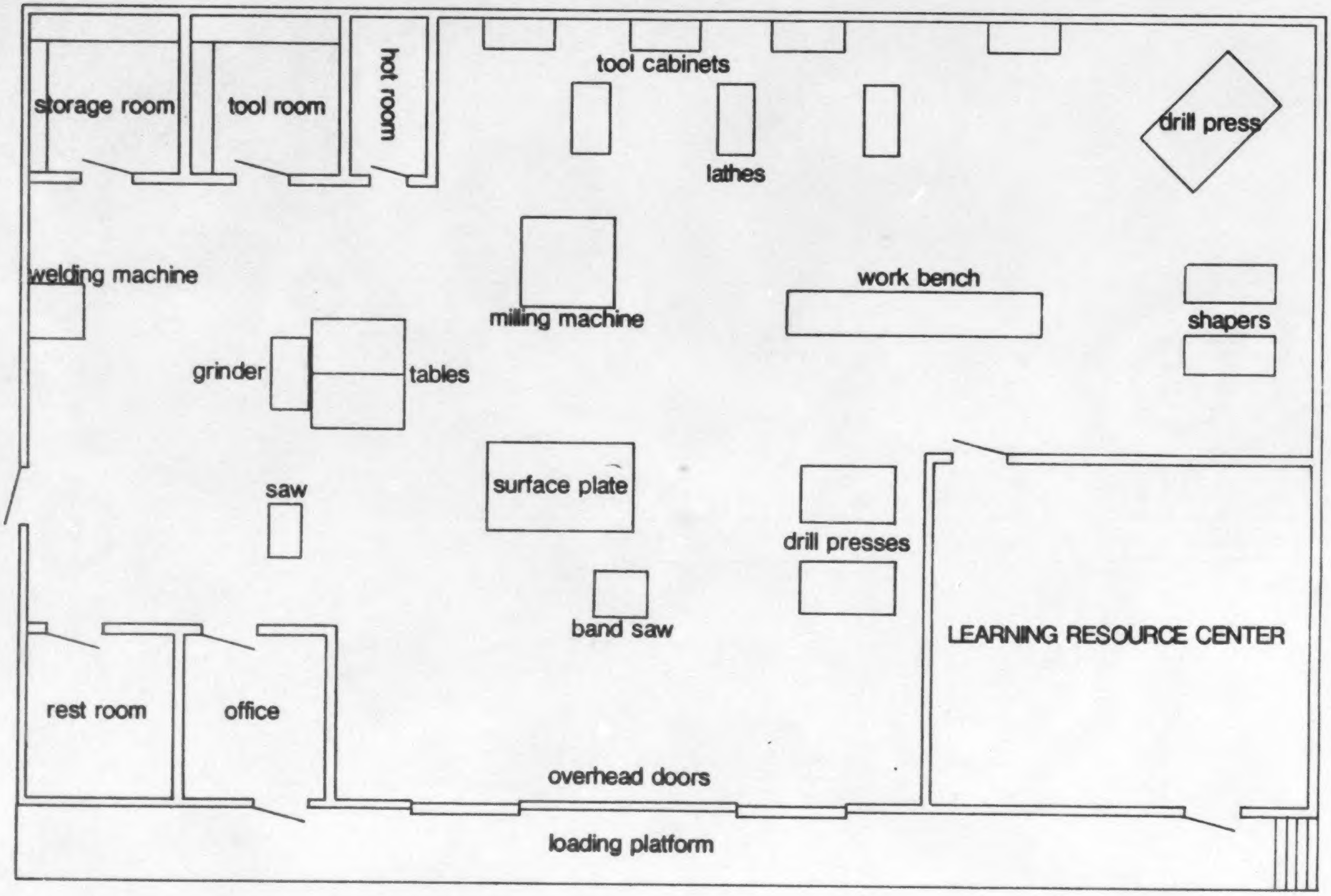
Scale: 1" = 4'


TRADE JOURNALS
CARRELS
REFERENCE BOOKS
WORK TABLE
STUDY TABLE
STUDY TABLE
AUDIO VISUAL STORAGE
LEARNING RESOURCE CENTER
STUDY TABLE
STUDY TABLE


to lab
window
special storage
audiovisual storage
reference books
INSTRUCTOR
window
reference books
chalkboard
group seating
LEARNING RESOURCE CENTER
(FOR LARGE SPACE)
carrel
carrel
carrel
VTR PLAYBACK POSITION
carrel
carrel
carrel
carrel
carrel
screen

Scale: 1" = 4'

MACHINE SHOP LABORATORY
FACILITY LAYOUT


storage room
tool room
hot room
tool cabinets
lathes
drill press
welding machine
milling machine
work bench
shapers
grinder
tables
saw
surface plate
drill presses
band saw
LEARNING RESOURCE CENTER
rest room
office
overhead doors
loading platform

SECTION X

DEFINITION OF TERMS

DEFINITION OF TERMS

1. AV's-Audiovisuals - May refer to any picture and/or sound media. (ie. slides, tapes, filmstrips, 16 mm films, etc.)

2. Checkpoint - A student-instructor interface point wherein the instructor may give the student a test, perform a demonstration, or simply provide the student with additional needed information or instructions. Also a checkpoint may be used for motivational purposes.

3. Competency - The ability (knowledge, skills and attitudes) to perform all of a group or cluster of related tasks required to complete a designated activity according to occupational standards. In the educational setting the statement of a competency includes expected student outcomes in terms of knowledge, skills, and attitudes required to complete a designated activity as defined by incumbent workers according to the standards of the work place.

4. Course - A grouping of tasks and competencies which have a common knowledge base or are within a given domain.

5. Criterion-Referenced Measure - An exercise based upon a performance objective, the accomplishment of which measures attainment of that objective.

6. Criterion-Referenced Test - A test designed to measure student competencies based on job or industrial standards.

7. Curriculum Guide - A document containing the objectives, content, organization, and structure of an instructional program. It is designed for use by administrators, instructional supervisors and teachers.

8. D.O.T. - Abbreviation for Dictionary of Occupational Titles. Document provides nine digit codes identifying each occupation.

9. Duty - One of the distinct major activities involved in the work performed, comprising related tasks.

10. Exit Point - A predetermined point within an instructional program in which a student may exit with the essential competencies for a specific job. Usually defined in terms of D.O.T. codes and/or O.E. codes.

11. "Hands-On" - Statement implying the student is physically involved in a learning activity.

12. Individualized Instruction (I.I.) - A system of instruction allowing for a student to progress at their fastest rate.

13. Job - A specific area of specialization within an occupational field consisting of several closely related duties for which a person would expect to receive remuneration. Should be identified by DOT code.

14. Job Sheet - (Or Operations Sheet) - A project of a performance nature. Generally performed by the student in a lab or shop type environment or in a specialized work area.

15. Live Work - Generally refers to items brought into the course area for repair or adjustment. Examples of live work might be automobiles, radios and TV's, air-conditioners, etc. Another form of live work would be patrons visiting the cosmetology department to receive permanents or other services.

16. Master Copies - Original copies of slides, tapes or written materials set aside for the purpose of duplication.

17. Occupational Cluster - A group of occupations sharing a common core of competencies. Georgia's comprehensive high school vocational program is organized around this concept.

18. Occupational Inventory - A listing of tasks to be performed in a particular occupational area, grouped under duty classifications.

19. O.E. - Refers to the U. S. Office of Education. O.E. codes are a classification system (taxonomy) for occupational education programs.

20. Open Entry - Term meaning that a student may enter the program at any time and does not have to wait for quarter or semester breaks.

21. Open Exit - Term meaning that a student may leave a program any time he/she completes their occupational objective.

22. Performance Guide - A series of steps, arranged in a sequence ordinarily followed, which when completed may result in the performance of a task. Also called "teaching steps."

23. Performance Objective - A statement in precise, measurable terms of a particular behavior to be exhibited by a learner under specified conditions. It possesses each of the elements or characteristics specified below:

    a. Condition - The testing situation confronting the learner is clearly specified. This includes equipment provided or withheld, environmental constraints such as temperature, space, etc.

b. Performance - The specific behavior expected of the learner is stated.

c. Standard - The degree of acceptable performance is specified.

24. Performance Test - A test entailing not only the ability to answer questions, but measuring the students' ability to operate, manipulate, or perform a given task as well.

25. Program - An organized sequence of courses leading to an occupational objective. A program may contain one or more student exit points as defined by D.O.T. codes.

26. Program Objective - The outcome of a prescribed program of instruction. Usually expressed in terms of the occupation or job for which training is designed. D.O.T. codes are frequently used to identify program objectives or student exit points.

27. Self-Paced - Refers to a student moving through the prescribed training program at the fastest pace at which the student can meaningfully learn.

28. Sequencing - Putting any set or series of learning activities or tasks into proper order or sequence. Normally arranged from the simple to complex within groupings or blocks.

29. Software - Written or printed materials, slides, filmstrips, tapes, etc.

30. Student Manual - A document designed for use by students in a specific instructional program. It contains unit sheets, references, operational procedures or job sheets, etc.

31. Task - The smallest division of work in which a measurable output occurs. A logical and necessary step in the performance of a duty.

32. Task List - A listing of tasks performed by incumbent workers within a domain of interest. An example is a listing of all tasks performed by an automotive mechanic or by a worker in ornamental horticulture.

33. Unit - One "module" training materials; generally covering one learning task and programmed on one Unit Sheet. May cover more than one lesson.

34. Unit Guide - A curriculum guide sheet that lists a task and objective with the instructional activities, instructional materials, evaluation and approximate time required for a student to successfully complete the task.

35. V-TECS Catalog - A comprehensive collection of performance objectives, performance guides, criterion-referenced measures, and related data, organized by a job structure or career ladder within a domain of interest.

Federal law prohibits discrimination on the basis of race, color or national origin (Title VI of the Civil Rights Act of 1964); sex (Title IX of the Educational Amendments of 1972 and Title II of the Vocational Education Amendments of 1976); or handicap (Section 504 of the Rehabilitation Act of 1973) in educational programs or activities receiving federal financial assistance.

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The following individuals have been designated as the employees responsible for coordinating the department's effort to implement this nondiscriminatory policy.

Title II - Loydia Webber, Vocational Equity Coordinator
Title VI - Peyton Williams Jr., Associate Superintendent of State Schools and Special Services
Title IX - Evelyn Rowe and Myra Tolbert, Coordinators
Section 504 - Jane Lee, Coordinator of Special Education

Inquiries concerning the application of Title II, Title VI, Title IX or Section 504 to the policies and practices of the department may be addressed to the persons listed above at the Georgia Department of Education, State Office Building, Atlanta 30334; to the Regional Office for Civil Rights, Atlanta 30323; or to the Director, Office for Civil Rights, Education Department, Washington, D.C. 20201.